N61165.AR.003243
CNC CHARLESTON
5090.3a

INTERIM FINAL RESOURCE CONSERVATION AND RECOVERY FACILITY INVESTIGATION WORK PLAN APPENDICES A TO U CNC CHARLESTON SC
10/14/1993
ENSAFE

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY CHARLESTON NAVAL SHIPYARD CHARLESTON, SOUTH CAROLINA

INTERIM FINAL RFI WORK PLAN APPENDICES A — U CHARLESTON NAVAL SHIPYARD

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
Washington, DC

SOUTHDIV Contract Number:
N62467-89-D-0318

Prepared by:

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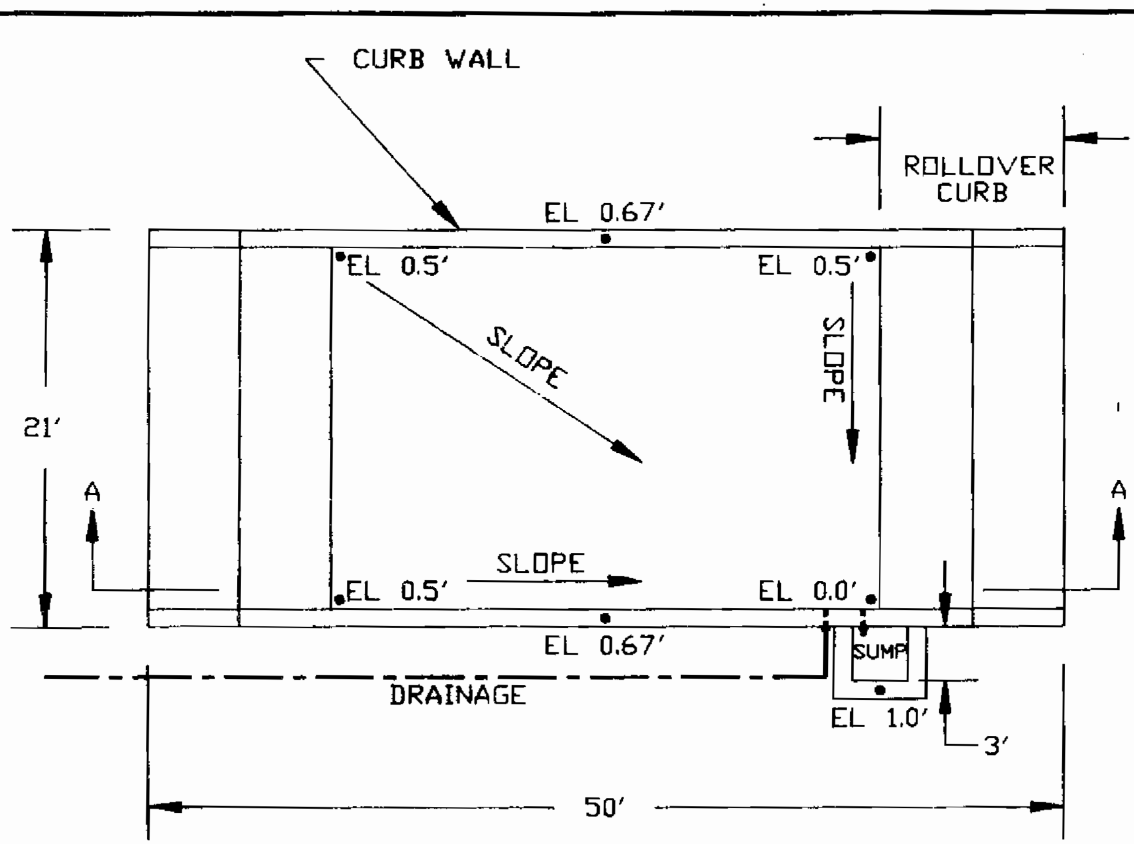
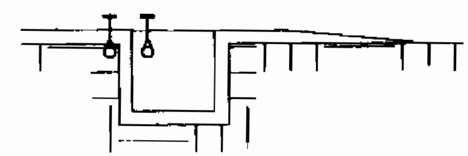
(901) 383-9115

October 14, 1993

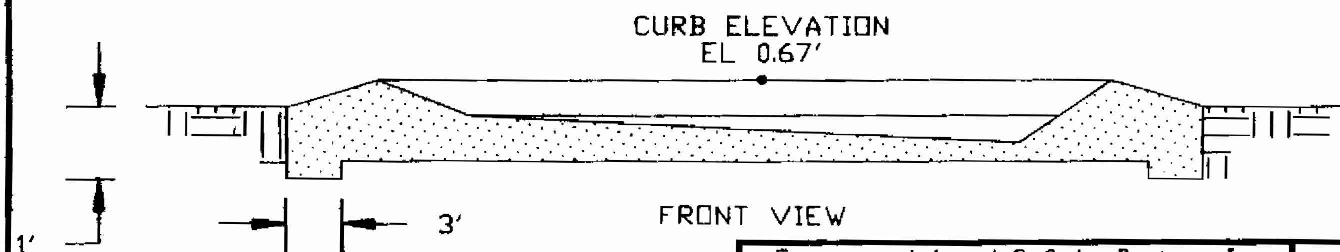


TOP VIEW

NOTE:
CURBS 6" THICK
SUMP WALLS 6" THICK
PAD 8" THICK
ADD 6X6 MESH IN PAD
ELEVATIONS ARE RELATIVE



SUMP DIMENSIONS
3'X 3'X 3'



FRONT VIEW

NOT TO SCALE

Environmental and Safety Designs, Inc.

EnSafe

5705 STAGE RD. MEMPHIS, TN. 38134 #(901)372-7962

DECONTAMINATION PAD

DATE: 3/8/90 | DWG NAME: DECONPAD

PROJECT CODE	NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST INV DATE
2267-001	EIGHTH STREET LANDFILL	05/07/93	CPG		CPG		8THST		Proc	
2053-015	Project Powder	09/21/89	CPG		CPG		AEA	Mr. Charles Cummings	Proc	01/04/91
4500-002	PROPOSAL	06/10/93	CPG		SJN		AEC	MR. PHIL COOP	Proc	
2252-001	GMA BUILDING	03/04/93	DJM		HPE		AIRPAR	MR. JIM MARTIN	Proc	09/03/93
2252-002	MTA-TEXTRON	04/16/93	DJM		HCT		AIRPAR	MR. JIM MARTIN	Proc	05/28/93
2180-001	Environmental assessment	08/12/91	SJN		PDW		ALFLEX	Gerald Hageen	Proc	11/08/91
2097-001	Testing	03/23/90	SPV		SPV		ALLOY	Don Vickrey	Proc	06/14/91
2280-001	GREENVILLE PHASE I	07/29/93	WCA		MRW		ALLPHS	MR. JOHN LARSON	Proc	09/03/93
2234-003	Phase I	02/12/93	DJM		PDW		ALLST	Dennis Ruetten	Proc	06/08/93
2215-001	ABMI-DENVER/PHOENIX	03/13/92	CPG		BME		AMBUIL	John Cunningham	Proc	06/08/92
2196-001	Ameritrust	10/24/91	CPG		SPV		AMERIT	Tim Ward	Proc	02/03/92
2141-001	Wastewater Sampling	11/13/90	SJN		AMR		AMPLEX	Lydia Morton	Proc	10/15/93
2105-004	ENVIRONMENTAL SERVICES	09/25/92	CPG		CPG		ARCAD	MS. DONNA SMITH	Proc	11/17/92
2105-005	UST CLOSURE	08/25/93	CPG		CPG		ARCAD	Mr. Bob Rover	Proc	10/15/93
2099-003	Hertz Site-Cannon Allen	01/17/92	CPG		CPG		ARMSTR	Mr. Gavin Gentry	Proc	04/28/92
2099-004	Memories Publishing	02/11/92	CPG		SPV		ARMSTR	Mr. Gavin Gentry	Proc	03/23/92
2099-005	MISC. SERVICES	06/19/92	CPG		SPV		ARMSTR	MR. STEVE HALE	Proc	07/17/92
2033-001	AWMP	10/26/92	SJN		WCA		AUTEC	MR. JOHN MULLER	Proc	07/30/93
2033-002	DHS SOP Copies	06/22/93	CPG		BRC		AUTEC	MR. JOHN MULLER	Proc	08/06/93
2157-001	Environmental Services	02/22/91	CPG		CPG		AUTO	Mr. John McCarroll	Proc	03/28/91
2251-001	EDISON ROOM VENT. DESIGN	03/01/93	CPG		BJH		BAKER	MR. CRAIG LLOYD	Proc	06/22/93
1091-002	Uhrichsville NPDES Permt	07/16/89	CPG		AMR		BARMET	David Mahaffey	Proc	10/15/93
1091-004	Livia, KY Stormwater	07/16/89	JNS		BBJ		BARMET	Waheed Khan	Proc	10/15/93
1091-005	Rockport, IN	07/16/89			CPG		BARMET	Waheed Kahn	Proc	10/27/93
1091-007	Ft. Hartford SPCC Plan	04/01/91	SJN		SJN		BARMET	Waheed Kahn	Proc	07/10/92
1091-010	ARTS PSA I	04/09/92	SJN		LRL		BARMET	Waheed Kahn	Proc	07/28/92
1091-013	URICH. PHASE II GW	09/15/92	SJN		SPV		BARMET	Waheed Kahn	Proc	10/15/93
1091-015	URICHSVILLE LANDFILL PER	11/30/92	DJM		DJM		BARMET	Waheed Kahn	Proc	
1091-016	AKRON UST	06/07/93	WCA		SJE		BARMET	Waheed Kahn	Proc	08/27/93
1091-099	OSHA- FT. HARTFORD	12/10/92	SJN		WMA		BARMET	Waheed Kahn	Proc	
2082-002	Environmental Services	04/16/90	CPG		WCA		BARR	Maxine Larson	Proc	08/[illegible]
2082-003	Storm water - Channel	07/31/91	CPG		WCA		BARR	Maxine Larson	Proc	10/15/93
2082-004	Storm Water Buoy	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	10/15/93
2082-006	Stripper/Leachate	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	10/15/93
2082-007	Channel Tank Farm/SPCC	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	07/19/93
2082-008	Buoy Tank Farm/SPCC	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	03/29/93
2082-009	CA. Tank Farm/SPCC	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	09/30/92
2082-010	MSDS	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	10/26/92
2082-011	Consulting Services	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	10/15/93
2082-012	Sewer Permits Channel	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	09/08/93
2082-013	Sewer Permits Buoy	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	09/30/93
2082-014	Air Permits Channel	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	07/19/93
2082-015	Air Permits Buoy	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	11/30/92
2082-016	Air Permits California	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	08/07/92
2082-017	Training	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	09/30/93
2082-018	New Products	09/24/91	CPG		WCA		BARR	Maxine Larson	Proc	08/10/93
2082-019	DOT	10/17/91	CPG		WCA		BARR	Maxine Larson	Proc	08/31/93
2082-020	Inv. of VOCs/IH Survey	09/24/91	CPG		BJH		BARR	Maxine Larson	Proc	02/12/93
2082-021	IH Survey	02/21/92	CPG		BJH		BARR	Maxine Larson	Proc	04/30/93
2082-022	Terminal Operations Mnl	04/13/92	CPG		MSD		BARR	Maxine Larson	Proc	08/07/92

PROJECT CODE	PROJECT NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST INV DATE
2082-023	GREEN RM. VENT.	07/31/92	CPG		BJH		BARR	Maxine Larson	Proc	11/30/92
2082-024	TCRI 313 REPORT	08/15/92	CPG		BTM		BARR	Maxine Larson	Proc	09/08/93
2082-025	FREON EMISSION	10/01/92	CPG		BJH		BARR	Maxine Larson	Proc	09/08/93
2082-026	FRIEDRICH RESIDENCE	10/19/92	CPG		BJH		BARR	JOHN GHIO	Proc	03/25/93
2082-027	Noise Survey	09/30/92	CPG		BJH		BARR	Maxine Larson	Proc	02/12/93
2082-028	clean air act	11/12/92	CPG		LRL		BARR	Maxine Larson	Proc	09/30/93
2082-031	SULFURIC ACID PROCESS	01/23/93	CPG		AEK		BARR	Maxine Larson	Proc	04/30/93
2082-032	134A MONITORING	02/05/93	CPG		BJH		BARR	Maxine Larson	Proc	06/08/93
2082-033	SPILL CONTINGENCY PLAN	02/11/93	SJN		BRC		BARR	Maxine Larson	Proc	09/30/93
2082-034	WWTP MODS	03/01/93	CPG		PMD		BARR	Maxine Larson	Proc	10/15/93
2082-035	WORKER EXPOSURE EVALUATI	03/31/93	CPG		BJH		BARR	Maxine Larson	Proc	10/15/93
2082-036	PUBLIC AFFAIRS	04/23/93	CPG		BRC		BARR	Maxine Larson	Proc	07/19/93
2082-037	AM-181	05/07/93	CPG		BRC		BARR	Maxine Larson	Proc	10/15/93
2082-039	STORMWATER MONITORING	05/20/93	CPG		LRL		BARR	Maxine Larson	Proc	08/31/93
2082-040	STORMWATER SAMPLING	06/23/93	CPG		WPJ		BARR	Maxine Larson	Proc	
2082-041	REWORK PROCESS	08/25/93	CPG		PMD		BARR	Maxine Larson	Proc	10/15/93
2082-042	CLEAN AIR ACT- CHANNEL	09/13/93	CPG		PMD		BARR	Maxine Larson	Proc	10/15/93
2082-043	DATABASE SEARCHES	09/24/93	CPG		CPG		BARR	Maxine Larson	Proc	
2082-044	CLEAN AIR ACT-HAPS	10/02/93	CPG		PMD		BARR	Maxine Larson	Proc	
2238-001	NATIONAL BUTANE	01/14/93	CPG		CPG		BASS	MR. WARNER BASS	Proc	
2238-002	SUMMERALL UST	05/20/93	WCA		WCA		BASS	MR. SCOTT THOMAS	Proc	10/15/93
2043-001	Underground Storage Tank	07/16/89			SPV		BATESV	Elbert Mitchell	Proc	07/30/93
2000-001	Environmental Services	07/16/89	CPG		BJJ		BELACE	Roy Bell, Jr.	Proc	09/12/91
2206-001	1691 SHELBY OAKS	02/03/92	CPG		BJJ		BELZ	MR. GARLAND CRAWFORD	Proc	09/[illegible]2
2206-002	Eastgate Cleaners	03/04/92	CPG		SPV		BELZ	MR. GARLAND CRAWFORD	Proc	10/[illegible]3
2206-004	DIESEL RECON	10/26/92	CPG		SPV		BELZ	MR. RON BELZ	Proc	07/26/93
2206-005	PEER REVIEW- SUMMER AVE	03/19/93	CPG		SPV		BELZ	MR. GARLAND CRAWFORD	Proc	08/27/93
2206-006	DEPOT REVIEW	05/24/93	CPG		CPG		BELZ	MR. GARLAND CRAWFORD	Proc	10/15/93
2206-007	RIDGEWAY PROPERTY REVIEW	07/19/93	CPG		MRW		BELZ	MR. GARLAND CRAWFORD	Proc	07/30/93
2206-008	MADISON, TN.	07/23/93	CPG		DCS		BELZ	MR. GARLAND CRAWFORD	Proc	08/27/93
2236-001	EASTGATE RCRA	12/10/92	CPG		SPV		BELZ2	NATHAN BICKS	Proc	10/15/93
2052-001	Fairlawn, NJ	07/16/89			CPG		BEROL	Mr. Robert Spies	Proc	03/12/90
2052-004	Environmental Services	11/09/90	CPG		CPG		BEROL	Mr. Robert Spies	Proc	12/07/92
2052-005	Spurlock Farm	04/08/91	CPG		HCT		BEROL	Mr. Robert Spies	Proc	10/15/93
2052-006	Environmental Assessment	07/15/92	CPG		PDW		BEROL	Mr. Robert Spies	Proc	01/28/93
2052-007	GRUMBACHER ECRA PLAN	09/29/92	CPG		AMR		BEROL	Mr. Robert Spies	Proc	10/15/93
2052-008	MISC. SERVICES	08/07/93	CPG		PDW		BEROL	MS. SHARDA DIXIT	Proc	10/18/93
1043-002	General Services	12/28/89	SJN		CPG		BHAMST	Sid Morgan	Proc	09/15/93
1043-006	Norfolk Fluff Dump	06/29/89	SJN		WCA		BHAMST	Sid Morgan	Proc	10/15/93
2283-001	ABI LANDFILL- TULLAHOMA	08/07/93	DJM		SNB		BILTRT	MR. HENRY WINKLEMAN	Proc	10/06/93
2166-001	Merchants EAP	03/28/91	CPG		SPV		BOAT	Greg Smithers	Proc	04/16/91
2302-002	Superior Nissan Phase I	03/20/92	CPG		BJJ		BOATMN	Bill Glaus	Proc	04/28/92
2302-003	West Ashley Toyota Pha I	03/20/92	CPG		BJJ		BOATMN	Bill Glaus	Proc	04/24/92
2302-004	Voirath	07/17/92	CPG		SPV		BOATMN	Mr. Troy Colvert	Proc	04/30/93
2167-001	Boardman Phase I	04/02/91			SPV		BOATSL	Nancy Yarbrough	Proc	08/15/91
2167-002	Boardman Phase II	06/11/91			SPV		BOATSL	Nancy Yarbrough	Proc	08/15/91
2133-001	Coca Cola 9-570063	10/12/90	CPG		AMR		BOGATN	Thad Rodda	Proc	05/28/93
2133-002	GLEN DODD HONDA	05/11/92	CPG		BJJ		BOGATN	RALPH HENSLEY	Proc	09/14/92
2133-003	COCA-COLA SYSTEM O & M	01/18/93	CPG		AMR		BOGATN	Wayne Pace	Proc	04/20/93
2289-001	CSI	09/08/93	CPG		CPG		BOULT	MS. CATHERINE MARKS	Proc	11/03/93

PROJECT CODE	PROJECT NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST INV DATE
1222-001	Osceola, AR Site	06/26/92	CPG		CPG		BOYLE	Robert J. Lofton	Proc	02/12/93
1222-002	PARK CENTER	02/11/93	CPG		CPG		BOYLE	Robert J. Lofton	Proc	04/20/93
1013-001	Buckman Environ Svcs.	07/16/89			CPG		BUCLAB	Mr. David Harris	Proc	07/30/93
1013-003	DOT Assessment	10/17/89	CPG		BRC		BUCLAB	Richard Lutey	Proc	04/30/91
1013-004	DOT Services	01/06/90	CPG		BRC		BUCLAB	Mr. Mark Buckman	Proc	09/03/91
1013-005	DOT Coordination	02/14/90	CPG		BRC		BUCLAB	Mr. David Harris	Proc	04/30/91
1013-006	Storage Trailer Issue	11/05/91	CPG		BJH		BUCLAB	Mr. David Harris	Proc	02/06/91
1013-007	DOT TRAINING	08/21/92	CPG		BRC		BUCLAB	MR. FRED SCRUGGS	Proc	03/17/93
1013-008	FOI REQUESTS	10/26/92	CPG		MRA		BUCLAB	MR. RICHARD LUTEY	Proc	04/01/93
1013-009	Buckman Labs	03/31/93	CPG		BJH		BUCLAB	Elizabeth Lewis	Proc	11/01/93
[illegible]-002	Omni Hotel	01/21/92	SJN		SPV		BURCH	Ken Besser	Proc	
1290-001	PHASE I	09/17/93	CPG		WPJ		BVPCAP	MS. SANDRA MURDOLLO	Proc	10/15/93
1113-007	Greensburg PSA	05/22/91	LRL		LRL		CALMAN	Mr. Bobby Raines	Proc	08/31/93
1113-008	Hope, Arkansas Audits	12/06/91	SJN		MSD		CALMAN	Mr. Bobby Raines	Proc	03/30/92
1113-010	TX PSA I	06/01/93	CPG		LRL		CALMAN	MR. M.G. HODGES	Proc	08/31/93
1113-011	ZETLING FARMS	05/28/93	WCA		LRL		CALMAN	Mr. Bobby Raines	Proc	08/31/93
1113-012	Phase II Assessment	06/25/93	SPV		SPV		CALMAN	Mr. Bobby Raines	Proc	10/15/93
1269-001	THOMAS PLANT AIR PERMITS	05/20/93	CPG		PMD		CARGIL	MR. JOHN SUTTON	Proc	11/01/93
1269-002	PERMIT FOR IND.WW DISCHR	09/24/93	CPG		PMD		CARGIL	MR. JOHN SUTTON	Proc	11/01/93
1273-001	KRAFT PHASE II	06/07/93	CPG		BJJ		CARGLL	MS. SHIRLEY R. BOYD	Proc	10/15/93
1273-003	THOMAS PLANT AIR EMISIO	09/13/93	CPG		PMD		CARGLL	MS. SHIRLEY R. BOYD	Proc	10/15/93
1048-002	Consulting Agreement	10/23/89	CPG		CPG		CARRNY	Mr. Nelson Wong	Proc	04/30/90
1048-025	McMinnville Site Investg	02/20/90	CPG		CPG		CARRNY	Mr. Nelson Wong	Proc	02/16/93
48-039	Waste Minimization plan	11/14/91	CPG		WCA		CARRNY	Mr. Nelson Wong	Proc	07/30/93
48-047	COLLIERVILLE RDRA	10/02/92	CPG		WCA		CARRNY	MR. NELSON WONG	Proc	10/15/93
1048-048	MCMINNVILLE REMEDIATION	01/27/93	CPG		RLR		CARRNY	MR. NELSON WONG	Proc	10/15/93
1048-052	CARLYLE REVIEW	04/08/93	WCA		BTP		CARRNY	MR. NELSON WONG	Proc	06/10/93
1048-056	ENTERPRISE RECOVERY	08/14/93	CPG		WCA		CARRNY	MR. NELSON WONG	Proc	10/15/93
1048-059	SVE TREATABILITY	11/02/93	WCA		RJD		CARRNY		Proc	
1048-036	Waste Minimization Plan	10/16/91	CPG		WCA		CARRTN	Mr. Carl Krull	Proc	02/05/92
1048-037	Miscellaneous Services	11/13/91	CPG		WCA		CARRTN	Mr. Carl Krull	Proc	10/14/93
1048-041	PLANT EXPANSION SAMPLING	01/28/92			WCA		CARRTN	Mr. Carl Krull	Proc	03/30/92
1048-042	1991 HAZ WASTE GEN AND M	02/20/92	CPG		WCA		CARRTN	Mr. Carl Krull	Proc	04/29/92
1048-044	SPECIAL WASTE PROJECT	03/17/92	CPG		WCA		CARRTN	Mr. Carl Krull	Proc	07/10/92
1048-045	AIR PERMIT APPLICATIONS	03/21/92	CPG		WCA		CARRTN	Mr. Carl Krull	Proc	05/13/92
1048-046	AIR PERMITS	03/24/92	CPG		AEK		CARRTN	Mr. Carl Krull	Proc	01/21/93
1048-049	STORMWATER MONITORING	03/04/93	CPG		WPJ		CARRTN	Mr. Carl Krull	Proc	09/01/93
1048-050	SOIL SAMPLING FOR TCE	03/09/93	WCA		LAR		CARRTN	Mr. Carl Krull	Proc	04/30/93
1048-053	REVISION FORM R	04/21/93	WCA		BTM		CARRTN	Mr. Carl Krull	Proc	
1048-054	TOXIC RELEASE FORMS	04/21/93	WCA		BTM		CARRTN	Mr. Carl Krull	Proc	09/07/93
1048-055	STORMWATER MONITORING	08/03/93	WCA		WPJ		CARRTN	MR. JOE HARVEY	Proc	
1048-057	BATTERY SHOP SAMPLES	09/24/93	WCA		WCA		CARRTN	Mr. Carl Krull	Proc	10/15/93
1048-058	STORMWATER TRAINING	10/18/93	PGC		PJW		CARRTN	Mr. Carl Krull	Proc	
2106-002	Carrier-Indianapolis	10/19/90	CPG		WCA		CARRWW	Mr. Nelson Wong	Proc	10/15/93
2106-008	Charlotte, NC	10/16/91	CPG		CPG		CARRWW	Mr. Nelson Wong	Proc	07/10/92
2106-009	Council Bluffs	02/21/92	CPG		CPG		CARRWW	Mr. Nelson Wong	Proc	01/11/93
2106-010	CLEARWATER PSI	04/27/92	CPG		LRL		CARRWW	Mr. Nelson Wong	Proc	10/13/92
2106-011	MONTREAL PSA	05/14/92	CPG		LRL		CARRWW	Mr. Nelson Wong	Proc	09/30/92
2106-013	SAN ANTONIO	07/16/92	CPG		ALM		CARRWW	Mr. Dale Sweet	Proc	09/22/93
2106-014	Tyler Texas Phase I	07/17/92	CPG		ALM		CARRWW	Mr. Nelson Wong	Proc	01/19/93

PROJECT CODE	PROJECT NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST inv DATE
2106-016	TYLER, TX, PHASE II	11/13/92	CPG		ALM		CARRWW	MR. LESLIE VARGHESE	Proc	03/25/93
2106-021	CLOSURE AUD- ELIJAY,GA.	03/04/93	CPG		LRL		CARRWW	MR. JEFF CARTER	Proc	06/07/93
2106-022	KENT, WA.	04/16/93	CPG		DCB		CARRWW	Mr. Nelson Wong	Proc	09/22/93
2106-023	PARKER ELECTRONICS	05/17/93	CPG		CPG		CARRWW	Mr. Nelson Wong	Proc	10/15/93
2106-025	SAVANNAH PHASE I	06/09/93	CPG		SPV		CARRWW	MR. JEFF CARTER	Proc	10/15/93
1048-040	Carrier IH survey	01/21/92	CPG		BJH		CARTN2	Woodrow Brown	Proc	01/11/93
4300-001	SECOND AVENUE WAREHOUSE	03/13/92	DJM		DJM		CDPARK	A. M. Downing	Proc	05/28/92
2162-001	Compliance Survey	03/05/91	CPG		BJJ		CEDAR	John K. Miles, Jr.	Proc	06/15/92
2162-003	REVISE RFI	03/03/92	CPG		BJJ		CEDAR	John H. Miles, Jr.	Proc	09/27/93
2162-004	INTERIM MEASURES	03/26/93	CPG		BJJ		CEDAR	John Wagner	Proc	09/07/93
2162-005	FACILITY INVESTIGATION	08/14/93	CPG		BJJ		CEDAR	John Wagner	Proc	10/15/93
2199-002	AUDIT/SPCC	03/17/92	CPG		WCA		CEDAR	MR. STEVE BOSWELL	Proc	07/31/92
2199-001	Env. Consultation	11/12/91	WCA		WCA		CEDCHE	Mr. Steve Boswell	Proc	02/26/92
0000	CLEAN Administration	01/09/91	SJN		SJN		CLEAN	N0000	Proc	09/24/93
0002	McGregor, TX GW Monitrg	03/21/91	SJN		SJN		CLEAN	N0002	Proc	10/18/93
0003	Indian Head Site Investi	05/24/91	SJN		SJN		CLEAN	N0003	Proc	09/24/93
0004	Indian Head RFA	03/08/91	SJN		SJN		CLEAN	N0004	Proc	07/20/93
0005	Quantico Closure	03/08/91	SJN		SJN		CLEAN	N0005	Proc	04/14/93
0007	DLA Pipeline Meeting	04/04/91	SJN		SJN		CLEAN	N0007	Proc	09/24/93
0010	Beeville, TX UST	05/22/91	SJN		SJN		CLEAN	N0010	Proc	10/18/93
0011	Lubbock, TX USTs	05/24/91	SJN		SJN		CLEAN	N0011	Proc	07/30/93
0012	Kingsville, TX USTs	05/24/91	SJN		SJN		CLEAN	N0012	Proc	09/24/93
0013	Cecil Field Contingency	06/11/91	SJN		SJN		CLEAN	N0013	Proc	09/17/93
0014	Mayport-Contingency	06/11/91	SJN		SJN		CLEAN	N0014	Proc	06/1[illegible]/93
0015	Beeville TX RCRA Tanks	06/28/91	SJN		SJN		CLEAN	N0015	Proc	09/[illegible]
0016	NAS Memphis - RFI	07/02/91	SJN		SJN		CLEAN	N0016	Proc	09/2[illegible]/93
0017	NAS New Orleans, LA	06/28/91	SJN		SJN		CLEAN	N0017	Proc	09/24/93
0018	NSA, New Orleans, LA SI	06/28/91	SJN		SJN		CLEAN	N0018	Proc	09/24/93
0019	Beeville, TX - SI	07/02/91	SJN		SJN		CLEAN	N0019	Proc	09/24/93
0020	Fuel farm, New Orleans	09/07/91	SJN		SJN		CLEAN	N0020	Proc	09/24/93
0023	NWIRP MCGREGOR, TX-RFI	09/30/91	SJN		SJN		CLEAN	N0023	Proc	09/24/93
0025	NWIRP Dallas, Tx	09/30/91	SJN		SJN		CLEAN	N0025	Proc	11/05/93
0026	NAS-MPHS-POR-AFTF	12/19/91	SJN		SJN		CLEAN	N0026	Proc	06/16/93
0028	Beeville, TX - CRP	12/09/91	SJN		SJN		CLEAN	N0028	Proc	04/14/93
0029	CNSY Charleston, SC RFI	12/27/91	SJN		SJN		CLEAN	N0029	Proc	11/05/93
0030	NWIRP-Bristol, TN	12/10/91	SJN		SJN		CLEAN	N0030	Proc	09/24/93
0032	HRS II & AR	01/06/92	SJN		SJN		CLEAN	N0032	Proc	03/04/93
0033	New Orleans, Waste Strea	02/01/92	SJN		SJN		CLEAN	N0033	Proc	10/18/93
0034	Kingsville, TX	02/08/92	SJN		SJN		CLEAN	N0034	Proc	09/24/93
0035	NAS,NALF, Beeville 15	02/05/92	SJN		SJN		CLEAN	N0035	Proc	09/24/93
0036	NAS PENSACOLA PRE-RI/FS	03/24/92	SJN		SJN		CLEAN	N0036	Proc	09/24/93
0037	Corpus Christi CRP	03/24/92	SJN		SJN		CLEAN	N0037	Proc	09/24/93
0039	NAS Dallas-Cont. Assess.	03/17/92	SJN		SJN		CLEAN	N0039	Proc	09/24/93
0040	NAS Mem UST-HOSP	03/24/92	SJN		SJN		CLEAN	N0040	Proc	09/24/93
0041	NAS CORPUS CHRISTI	03/24/92	SJN		SJN		CLEAN	N0041	Proc	12/31/92
0042	NAS CORPUS CHRISTI	03/24/92	SJN		SJN		CLEAN	N0042	Proc	12/15/92
0043	NS Mayport	04/30/92	SJN		SJN		CLEAN	N0043	Proc	09/17/93
0044	HRS-NAS/NSA N.O. CHARLES	05/14/92	SJN		SJN		CLEAN	N0044	Proc	09/17/93
0045	DW/WO CHARLESTON	06/15/92	SJN		SJN		CLEAN	N0045	Proc	10/18/93
0046	AR PENSACOLA	06/15/92	SJN		SJN		CLEAN	N0046	Proc	09/17/93

-----PROJECT----- CODE	NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST INV DATE
0047	MCRC WILMINGTON-CAR	06/15/92	SJN		SJN		CLEAN	N0047	Proc	09/24/93
0048	NASPA-OU #10	06/15/92	SJN		SJN		CLEAN	N0048	Proc	09/24/93
0049	NAS. N.O. TABLE TOP DRLL	07/31/92	SJN		SJN		CLEAN	N0049	Proc	06/16/93
0050	NAS CORPUS OHS CONTINGEN	07/31/92	SJN		SJN		CLEAN	N0050	Proc	09/17/93
0051	NAS KEY WEST -0B/0B	09/21/92	SJN		SJN		CLEAN	N0051	Proc	04/14/93
0052	NAVBASE-CHARLESTON OHS	09/21/92	SJN		SJN		CLEAN	N0052	Proc	10/18/93
0053	NAS NEW ORLEANS-RI	09/21/92	SJN		SJN		CLEAN	N0053	Proc	09/24/93
0054	NSA- NEW ORLEANS RI	09/21/92	SJN		SJN		CLEAN	N0054	Proc	09/24/93
0055	NMCRC BROKEN ARROW CAR	09/21/92	SJN		SJN		CLEAN	N0055	Proc	09/24/93
0056	NAS KINGSVILLE-704, 3788	09/21/92	SJN		SJN		CLEAN	N0056	Proc	09/24/93
0057	1992 PMO	09/21/92	SJN		SJN		CLEAN	N0057	Proc	09/24/93
0058	NASPA-SITES 2,11,30,38	11/17/92	SJN		SJN		CLEAN	N0058	Proc	09/24/93
0059	NAS PENSACOLA CATEGORY 2	11/24/92	SJN		SJN		CLEAN	N0059	Proc	09/24/93
0060	NRS-DALLAS	11/05/92	SJN		SJN		CLEAN	N0060	Proc	04/14/93
0061	ADMINISTRATIVE RECORDS	11/24/92	SJN		SJN		CLEAN	N0061	Proc	09/24/93
0062	NAS CHASE-SWMU 54	12/15/92	SJN		SJN		CLEAN	N0062	Proc	10/18/93
0063	NASPA- PSC 36	02/02/93	SJN		SJN		CLEAN	N0063	Proc	09/24/93
0064	NAVBASE CHAS-OHS PILOT	02/02/93	SJN		SJN		CLEAN	N0064	Proc	09/24/93
0065	NAS CORPUS-EPRA, PHASEII	02/02/93	SJN		SJN		CLEAN	N0065	Proc	09/24/93
0066	NAS CHASE- VARIOUS PLANS	02/12/93	SJN		SJN		CLEAN	N0066	Proc	09/24/93
0067	NAS MEM- FLYING CLUB	02/13/93	SJN		SJN		CLEAN	N0067	Proc	09/24/93
0068	NAS MEM SITE S-50	04/16/93	SJN		SJN		CLEAN	N0068	Proc	09/24/93
0069	NAS CORPUS-RFI	04/16/93	SJN		SJN		CLEAN	N0069	Proc	09/24/93
70	NASP -CATEGORY 5	04/27/93	SJN		SJN		CLEAN	N0070	Proc	09/24/93
1	NASP- CATEGORY 6	04/27/93	SJN		SJN		CLEAN	N0071	Proc	09/24/93
0072	NASP ADMINISTRATION	07/29/93	SJN		SJN		CLEAN	N0072	Proc	09/24/93
0073	DLA- FLORIDA, ETC.	06/09/93	SJN		SJN		CLEAN	N0073	Proc	09/24/93
0074	NRC GREENSBORO,NC- UST	06/30/93	SJN		SJN		CLEAN	N0074	Proc	09/24/93
0075	NWS CHARLESTON-OB/OD MOD	07/05/93	SJN		SJN		CLEAN	N0075	Proc	09/24/93
0076	BRAC-BECS POAs	07/19/93	SJN		SJN		CLEAN	N0076	Proc	09/24/93
0077		10/14/93	SJN		SJN		CLEAN	James N. Speakman	Proc	
0078		09/24/93	SJN		SJN		CLEAN	James N. Speakman	Proc	
0970	NASP-CATEGORY 7	07/29/93	SJN		SJN		CLEAN	N0970	Proc	09/24/93
2024-002	PCB SAMPLING	05/14/92	CPG		TGL		COASTL	MR. LARS DALEN	Proc	08/06/92
2277-001	PSA- 3 SITES	07/12/93	DJM		DJM		COLUMB	MR. HARRY DEMCREST	Proc	10/27/93
2130-002	Winston Salem, N.C.	05/03/91	CPG		CPG		CONWOD		Proc	09/04/91
2130-003	Springfield, TN	01/22/92	CPG		PDW		CONWOD	Kenneth Mason	Proc	07/28/92
2130-004	CLARKSVILLE PLANT	08/10/92	CPG		PDW		CONWOD	WALDO GRESHAM	Proc	10/26/92
2130-005	SANFORD, NC AUDIT	09/08/93	CPG		CPG		CONWOD		Proc	10/15/93
2210-001	COOPER TIRE	12/05/91	CPG		SPV		COOPER	JOHN ORGAIN	Proc	07/07/93
2210-002	OVERSIGHT	04/23/93	CPG		SPV		COOPER	MR. JOHN ORGAIN	Proc	08/27/93
2210-003	REPORT REVIEW	04/23/93	CPG		SPV		COOPER	MR. JOHN ORGAIN	Proc	
2262-001	AIR PERMIT	04/29/93	DJM		PDW		CREATE	MR. DAVE LHEUREUX	Proc	07/30/93
2139-001	Croda Ink, Memphis	11/09/90	CPG		CPG		CRODA	Mr. Thomas Lynch	Proc	04/30/93
2139-009	CRODA INK USTS	07/13/92	CPG		BJJ		CRODA	Mr. Howard Crystal	Proc	04/15/93
2139-010	CRODA STORMWATER	09/17/92	CPG		LRL		CRODA	STEVE HALE	Proc	06/25/93
2193-001	Kentucky Conwood	10/14/91	CPG		LRL		CRUMP	Allen Malone	Proc	06/26/92
2244-001	CUPRO	02/05/93	CPG		WCA		CUPRO	MR. T. SUZUKI	Proc	08/27/93
2255-001	REVIEW DATA MAP	03/20/93	CPG		WCA		DAVIS	R. Bradford Fawley	Proc	10/11/93
2255-002	PRATT & WHITNEY CONSULT.	05/28/93	WCA		WCA		DAVIS		Proc	08/09/93

Environmental and Safety Designs, Inc.
Project Management System
PROJECT MASTER ROSTER
11/08/93

PROJECT CODE	PROJECT NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST INV DATE
2255-003	SITE VISIT	05/28/93	WCA		WCA		DAVIS		Proc	09/27/93
2270-001	PHASE I ASSESSMENT	05/20/93	DJM		PDW		DAY	MR. DAVID DAYWALT	Proc	10/12/93
2228-001	AIR PERMIT REVIEW	09/14/92	CPG		AEK		DOW	JOHN NAIN	Proc	12/02/92
2228-002	ASBESTOS	10/19/92	CPG		BJH		DOW	JOHN NAIN	Proc	08/25/93
2228-003	INDOOR AIR QUALITY	10/21/92	CPG		BJH		DOW	JOHN NAIN	Proc	08/09/93
2228-004	AIR PERMIT BAGHOUSES	02/12/93	CPG		AEK		DOW	JOHN NAIN	Proc	06/22/93
2228-005	HW MANIFESTING	07/01/93	CPG		MRA		DOW	ANNE INCE	Proc	09/27/93
1051-002	Environmental Services	07/16/89			CPG		DREXEL	David Alberg	Proc	01/30/90
1051-003	DOT Services	01/11/90	BRC		BRC		DREXEL	David Alberg	Proc	03/07/90
2187-001	Dunavant Enterprises	09/16/91	CPG		CPG		DUNAV	Louis Baroni	Proc	10/30/91
5001-001	INVESTMENT	11/26/91	CPG		CPG		EDI	MIKE WOOD	Proc	
9000-001	CLIENT NEWSLETTER	04/23/93	WMA		WMA		ENSAFE	MIKE WOOD	Proc	
9000-100	GEOLOGICAL SERVICES	11/17/92	CPG		SPV		ENSAFE	MIKE WOOD	Proc	
9000-200	SCIENTIFIC SERVICES	11/17/92	CPG		BJJ		ENSAFE	MIKE WOOD	Proc	
9000-300	HSS SERVICES	11/17/92	CPG		BRC		ENSAFE	MIKE WOOD	Proc	
9000-400	ENGINEERING SERVICES	11/17/92	CPG		WCA		ENSAFE	MIKE WOOD	Proc	
9000-500	COMPLIANCE SERVICES	11/17/92	CPG		LRL		ENSAFE	MIKE WOOD	Proc	
9000-600	DISCRETIONARY ADMIN.	11/17/92	CPG		WMA		ENSAFE	MIKE WOOD	Proc	
9000-701	NASHVILLE ADMIN.	11/17/92	CPG		DJM		ENSAFE	MIKE WOOD	Proc	
9000-702	PENSACOLA ADMIN.	11/17/92	CPG		SPV		ENSAFE	MIKE WOOD	Proc	
9000-703	RALEIGH ADMIN.	11/17/92	CPG		CPG		ENSAFE	MIKE WOOD	Proc	
9000-704	PROJECT OFFICE ADMIN.	11/17/92	CPG		WMA		ENSAFE	MIKE WOOD	Proc	
9000-800	REMEDIATION SERVICES	12/15/92	CPG		WCA		ENSAFE	MIKE WOOD	Proc	
2294-001	ERS OVERSIGHT	10/29/93	PGC		JJB		ERS	MR. A. C. WORRELL,III	Proc	
2100-001	EPA vs Leone	04/19/90	CPG		CPG		FISHER	W. H. Fisher III	Proc	10/
2258-001	SPILL RESPONSE	04/12/93	WCA		WCA		FLORAT	MR. BILL BYRNES	Proc	06/07/93
2191-001	Greenville Assessment	09/24/91	DJM		PDW		FORMEX	Mr. Frank Wall	Proc	02/05/92
2191-003	STORM WATER PERMITTING	03/17/92	DJM		PDW		FORMEX	Mr. Frank Wall	Proc	10/26/92
2191-004	ENVIRONMENTAL SERVICES	03/17/92	DJM		PDW		FORMEX	Mr. Frank Wall	Proc	
2154-001	Develop WW Disposal Plan	01/21/91	SJN		AMR		GBACH	Mr. Bill Stovall	Proc	10/13/93
2154-002	Myers Audit	02/21/91	SJN		AMR		GBACH	Mr. Bill Stovall	Proc	07/30/93
2154-003	STORM WATER PERMITTING	09/02/92	CPG		LRL		GBACH	Mr. Bill Stovall	Proc	09/17/93
1092-003	Watch Service	07/16/89	CPG		BRC		GEFF	Mr. Robert Hasken	Proc	05/24/91
1092-004	Transportation Assessmt.	07/16/89	CPG		BRC		GEFF	Mr. Robert Hasken	Proc	09/08/89
1092-005	Revise Mgmt. Guide	03/23/90	CPG		BRC		GEFF	Mr. Robert Hasken	Proc	12/27/91
1092-006	Revise Shipping Guide	03/23/90	CPG		BRC		GEFF	Mr. Robert Hasken	Proc	02/18/92
1092-007	RETAINER	10/27/92	CPG		BRC		GEFF	Mr. Robert Hasken	Proc	08/09/93
2190-001	Auted Bilge Water Test	09/20/91	SJN		BME		GEGOVN	Lora Wellman	Proc	01/20/92
1003-009	PHASE I	05/01/93	CPG		CPG		GESEL	Mr. Jim Fredrickson	Proc	08/16/93
1003-107	NPDES	02/01/91	CPG		CPG		GESEL	Mr. Jim Fredrickson	Proc	05/20/93
1003-108	Attend Public Meeting	01/13/92	CPG		CPG		GESEL	Mr. Jim Fredrickson	Proc	03/20/92
2279-001	HALL TN. LANDFILL REVIEW	07/15/93	DJM		SNB		GLANKL	MR. RANDALL WOMACK	Proc	09/21/93
2141-003	Norfolk	11/05/91	BRC		BRC		GPC	Mr. Arthur Holt	Proc	
2148-001	Revise NOSC Course	12/24/90	CPG		CPG		GPC	Mr. Arthur Holt	Proc	06/25/91
2148-002	Seattle OSC Course	08/14/91	CPG		BRC		GPC	Mr. Arthur Holt	Proc	11/18/91
2148-003	Norfolk NOSC Course	10/28/91	CPG		BRC		GPC	Mr. Arthur Holt	Proc	12/30/91
2148-009	REVISIONS	02/01/93	CPG		BRC		GPC	Mr. Arthur Holt	Proc	07/30/93
2148-010	MAYPORT NOSC COURSE	04/23/93	CPG		BRC		GPC	Mr. Arthur Holt	Proc	05/28/93
2148-011	ROTA, SPAIN WORKSHOP	07/19/93	CPG		CPG		GPC	Mr. Arthur Holt	Proc	08/27/93
2148-012	SAN DIEGO COURSE	08/03/93	CPG		BRC		GPC	Mr. Arthur Holt	Proc	10/15/93

-------PROJECT------- CODE	NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST INV DATE
2126-002	Millington	12/19/90	CPG		SPV		GRACE	Louis E. Ingram	Proc	01/14/91
2126-003	Rem. Est. Cost Analysis	12/24/90	CPG		SPV		GRACE	Louis E. Ingram	Proc	02/28/91
2126-005	MICHIE DUMP PHASE II	08/24/92	CPG		SPV		GRACE	Dave Tucker	Proc	10/15/93
2291-001	CLOSE DOE UST	09/17/93	DJM		FDW		HAMPSH	MR. STEVE KNAPP	Proc	
2291-002	H&S ASSESSMENT	10/08/93	DJM		FDW		HAMPSH	MR. STEVE KNAPP	Proc	
2179-002	HULING AVENUE SITE	01/27/92	CPG		BJJ		HANDV	JEFF BENNETT	Proc	11/30/92
2179-003	AVIATION MATERIALS PROP	07/29/92	CPG		CPG		HANDV	MS. HELYN KEITH	Proc	05/28/93
2241-001	DIESEL RECON	01/20/93	CPG		SPV		HARKAV	MR. JERRY BROADHURST	Proc	07/30/93
2233-001	VOLUNTEER CIRCUITS	10/08/92	CPG		CPG		HARRIS	WILLIAM W. DUNLAP, JR.	Proc	
2239-001	Southern/Pacific Railroa	02/25/92	SPV		SPV		HAWKIN		Proc	03/12/92
2198-001	Phase I-Weaver Rd	11/05/91	CPG		SPV		HAYNIE	Robert L. Haynie	Proc	01/21/92
2200-001	Mitchell Rd. Phase I	12/06/91	CPS		SPV		HEISKL	Jack E. Melvin, Jr.	Proc	08/31/92
2200-002	GEO & ENV SERVICES, IN	08/25/93	WMA		WMA		HEISKL	MR JIM McKOON	Proc	10/15/93
1002-004	Misc. Services	07/16/89			CPS		HELENA	Mr. Ed Brister	Proc	07/30/93
1002-005	Fairfax	07/16/89			SPV		HELENA	Mr. Ed Brister	Proc	10/15/93
1002-007	Humboldt	07/16/89			CPG		HELENA	Mr. Ed Brister	Proc	01/28/93
1002-008	Stauton	07/16/89			CPG		HELENA	Mr Ed Brister	Proc	
1002-009	Tampa, FL	07/16/89	CPG		SPV		HELENA	Mr. Ed Brister	Proc	10/15/93
1002-010	Enfield, NC Sampling	08/05/89	CPG		CPG		HELENA	Mr. Ed Brister	Proc	01/28/93
1002-013	Cameron, SC	04/30/90	CPG		SPV		HELENA	Mr. Ed Brister	Proc	09/07/93
1002-014	Haiti, MO	01/31/91	SPV		SPV		HELENA	Mr. Ed Brister	Proc	03/08/93
1002-015	Belzoni, MS	06/03/91	CPG		CPG		HELENA	Mr. Ed Brister	Proc	07/26/91
1002-016	Southern/Pacific Railroa	12/31/91	SJN		SPV		HELENA	Mr. Steve Hawkins	Proc	02/25/92
1002-017	Fairfax Removal	02/26/92	CPG		SPV		HELENA	Mr. Ed Brister	Proc	01/28/93
1002-018	Fairfax HPD Treatability	06/24/92	CPG		WCA		HELENA	Mr. Ed Brister	Proc	12/07/92
1002-019	STAYTON, OR FIRE CODE	08/11/92	CPG		BRC		HELENA	Mr. Ed Brister	Proc	01/04/93
1002-020	LIMA, N.Y.	08/15/92	CPG		SPV		HELENA	Mr. Ed Brister	Proc	09/07/93
1002-021	FABENS, TEXAS	09/28/92	CPG		SPV		HELENA	Mr. Ed Brister	Proc	10/15/93
1002-022	MER ROUGE, LA.	10/05/92	CPG		CPG		HELENA	Mr. Ed Brister	Proc	05/11/93
1002-023	LAURENBURG, N.C.	01/12/93	CPG		SPV		HELENA	Mr. Ed Brister	Proc	10/15/93
1002-024	Helena SPCC Plan	02/12/93	JJN		LAR		HELENA	Mr. Ed Brister	Proc	05/11/93
1002-025	FIRE CODE, N.C.	04/13/93	CPG		BJH		HELENA	Mr. Ed Brister	Proc	10/04/93
1002-026	Albany GA Fire Code	06/22/93	CPG		BJH		HELENA	Dale Cox	Proc	10/04/93
1002-027	PLANT SPCCs	09/02/93	CPG		LAR		HELENA	Mr. Ed Brister	Proc	
1002-028	SWPPP- WEST HELENA, AR	10/18/93	CPG		LRL		HELENA	Mr. Ed Brister	Proc	
2027-001	NASHVILLE AIRPORT	08/24/92	CPG		HCT		HERTZ	SUSAN P. KLINGENSTEIN	Proc	12/21/92
2268-001	PCB CLEANUP	05/20/93	CPG		WCA		HUNTER	JAMES L. WINTERS	Proc	10/15/93
2137-001	Delisting K044 & K045	10/31/90	CPG		CPG		INDIAN	Officer in Charge	Proc	05/20/93
2137-002	PHASE II- DELISTING	07/20/92	CPG		CPG		INDIAN	MS. SHEILA LUNDSTROM	Proc	07/01/93
2182-001	Aug. 91	08/15/91	CPG		BRC		INHTRA		Proc	10/17/91
2220-001	Jacson PSA	06/12/92	CPG		BJJ		JACKSO	Ms. Sherry Bray	Proc	12/28/92
4001-001	Insurance	08/23/91	CPG		SSA		KAYSER	James M. Boggs	Proc	05/11/93
4001-007	PRE-DESIGN WORK PLAN	11/17/92	CPG		SSA		KAYSER	James M. Boggs	Proc	10/19/93
4001-008	GEN. AND ADMINISTRATIVE	12/15/92	CPG		SSA		KAYSER	James M. Boggs	Proc	10/15/93
4001-010	Phase I - Pre-design	04/05/93	CPG		SSA		KAYSER	James M. Boggs	Proc	10/15/93
4001-011	PHASE II GW ACTIVITIES	04/16/93	CPG		SSA		KAYSER	James M. Boggs	Proc	10/15/93
4001-013	PHASE II QUARTERLY	09/17/93	PGC		SSA		KAYSER	James M. Boggs	Proc	10/15/93
1098-008	Air survey	11/22/91	CPG		LRL		KELLOG	Mr. J. W. Bendall	Proc	01/15/93
1098-009	Environmental Services	04/08/92	CPG		LRL		KELLOG	Mr. J. W. Bendall	Proc	02/26/93
1098-010	REVIEW AIR PERMITS	04/20/92	CPG		LRL		KELLOG	Mr. J. W. Bendall	Proc	10/12/92

PROJECT CODE	NAME	ENTRY DATE	Princi	P-3	Manage	P-1	CLIENT CODE	CLIENT PROJECT Manager	STAT	LAST DATE
1098-011	AIR EMISSIONS PERMIT APP	03/08/93	CPG		LRL		KELLOG	MR. EDDIE KEENE	Proc	10/11/93
2003-001	PART B REVISION	07/31/92	CPG		WPJ		KILGRE	Mr. Danny Brewer	Proc	08/09/93
2003-002	Unit Justification	01/07/91	CPG		CPG		KILGRE	Mr. Danny Brewer	Proc	02/23/93
2003-006	CONSULTING SERVICES	08/18/92	CPG		LRL		KILGRE	Mr. Danny Brewer	Proc	10/15/93
2003-008	STORMWATER	02/26/93	CPG		MRA		KILGRE	Mr. Danny Brewer	Proc	10/15/93
2003-009	STORMWATER SAMPLING	08/02/93	CPG		LRL		KILGRE	Mr. Danny Brewer	Proc	10/20/93
2003-010	BAFFLE SYSTEM	10/04/93	CAW		CAW		KILGRE	Mr. Danny Brewer	Proc	
2285-001	LAGOON CLOSURES	08/16/93	SPV		AMR		KING	MR KEN KING	Proc	10/25/93
2239-001	LITIGATION SUPPORT	01/14/93	CPG		CPG		KIRKPA	MR DAVID CASE	Proc	10/15/93
2243-001	EMER. RESPONSE TRAINING	01/27/93	CPG		MCD		KOBE	MR. JOHN TASSITINO	Proc	05/12/93
2284-001	RCRA PART B RENEWAL	08/14/93	SJN		MRW		LANDIV	ANDY SHANKS	Proc	
2284-002	HWMP-NAS KEFLAVIK	08/25/93	SJN		SJN		LANDIV	ANDY SHANKS	Proc	
2284-003	SWMU PLAN -KEFLAVIK	10/21/93	JNS		NBS		LANDIV	ANDY SHANKS	Proc	
2284-004	SWMU ASSESSMENT-LEJEUNE	10/21/93	JNS		RWM		LANDIV	ANDY SHANKS	Proc	
1038-009	NAS OCEANA-CLOSURE PLAN	02/12/93	SJN		SJN		LANDV	Commander-Will Bullard	Proc	
2157-004	Ground Water Monitoring	11/13/91	SJN		SJN		LANDV	Commander	Proc	09/29/93
2157-005	RCRA PART B- RROADS	12/13/91	SJN		SJN		LANDV	Commander	Proc	
2157-006	LF-6B Scooping Mtg	02/10/92	SJN		SJN		LANDV	Commander	Proc	
2157-007	LF_68 Spec	02/10/92	SJN		SJN		LANDV	Commander	Proc	
2157-008	LF-68 Sampling	02/25/92	SJN		SJN		LANDV	Commander	Proc	
2157-009	Closure Plan Revision	02/29/92	SJN		SJN		LANDV	Commander	Proc	
2157-010	NAB Little Creek	02/29/92	SJN		SJN		LANDV	Commander	Proc	
2157-011		04/24/92	SJN		SJN		LANDV	Commander	Proc	
2157-012	Closure Plans & Specs YT	07/31/92	SJN		SJN		LANDV	Commander	Proc	
2157-013	CLOSURE PLAN OTTO TANKS	09/21/92	SJN		SJN		LANDV	Commander	Proc	
2157-014	NAVBASE NORFOLK	10/14/92	SJN		SJN		LANDV	Commander	Proc	
2157-015	NAB LITTLE CREEK	10/14/92	SJN		SJN		LANDV	Commander	Proc	
2157-016	NAB LITTLE CREEK-106/110	10/14/92	SJN		SJN		LANDV	Commander	Proc	
2157-017	NAS OCEANA	10/14/92	SJN		SJN		LANDV	Commander	Proc	
2157-018	NAVSTA YORKTOWN-SITECHAR	10/14/92	SJN		SJN		LANDV	Commander	Proc	
2157-019	MCB CAMP LEJEUNE	10/14/92	SJN		SJN		LANDV	Commander	Proc	
2157-020	AFWTF OB/OD PART B REVIS	02/05/93	SJN		SJN		LANDV	Commander	Proc	
2157-021	LF-68 CLOSURE CERTIFICAN	08/23/93	SJN		SJN		LANDV	Commander	Proc	
2260-001	DAM CREEK INVENTORY	04/19/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	09/27/93
2260-002	LITTLE CREEK HAZMIN	04/19/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	
2260-003	OCEANA HAZMIN	04/19/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	
2260-004	ROOSRDS PART B REVISION	04/19/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	
2260-005	AFWTF VIEQUES PART B REV	05/25/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	
2260-006	Roosevelt Rds bldg 121 C	06/22/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	
2260-007	YORKTOWN EE/CA	08/07/93	SJN		SJN		LANTDV	MR. ANDY SHANKS	Proc	
2249-001	MID AMERICA RECYCLING	02/26/93	CPG		CPG		LAZARO	MR. BUDDY LAZAROV	Proc	03/29/93
2249-002	THIRD STREET SCRAP YARD	11/03/93	CPG		SJE		LAZARD	MR. BUDDY LAZAROV	Proc	
2051-002	Training	07/15/91	CPG		BRC		LEJEUN		Proc	09/23/91
1038-002	OB/OD	07/27/90	CPG		CPG		LNDIV	_	Proc	06/15/92
1038-003	RR Rds. Pt. B MODs	03/08/90	CPG		CPG		LNDIV	Lantdiv	Proc	10/12/90
1038-005	Norfolk Part B & Closure	12/04/90	SJN		SJN		LNDIV	_	Proc	
1038-006	Yktn. Pt. B. & Closures	07/17/89			SJN		LNDIV	_	Proc	
2021-007	NOS Louisvilly, KY SPCC	10/16/90	SJN		SJN		LNDV	_	Proc	04/26/91
2021-008	NOS LOUISVILLE	10/14/92	SJN		SJN		LNDV	COMMANDER	Proc	
2014-012	MCB Camp Lejeune-Train	07/09/91	CPG		BRC		LNTDV	_	Proc	

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2242-001	ENVIRONMENTAL SERVICES	01/25/93	SJN		DJM		LONG	MR. LOUIS CROSSLEY	Proc	03/26/93
1041-001	Lejeune Used Oil Mgmt.	07/17/89			SJN		LTDIV	-	Proc	08/31/92
1041-003	Lejeune Update Oil Mgt	07/17/89			SJN		LTDIV	-	Proc	
2189-001	567 Highland Asbestos	09/20/91	CPG		SPV		MACDUF	James M. Glenn, III	Proc	10/24/91
2165N001	Contingency Plan	03/21/91	DJM		DJM		MALARD	Bill Noel	Proc	06/25/91
2168-001	IATA Training	04/09/91	CPG		BRC		MAYBE		Proc	06/05/91
2168-002	INCINERATOR REVIEW	01/14/93	CPG		LRL		MAYBE	MR. GARY WILKERSON	Proc	05/12/93
2168-003	SEMINAR	03/26/93	CPG		BRC		MAYBE		Proc	07/06/93
2235-001	MBCI	11/13/92	CPG		SPV		MBCI	KENNETH MADDOX	Proc	01/28/93
2235-002	IPS-STAFFORD	11/16/92	CPG		SPV		MBCI	KENNTH MADDOX	Proc	12/31/92
2235-003	BYRAM, MS	06/07/93	LRL		BTM		MBCI	KENNTH MADDOX	Proc	06/23/93
2235-005	PHASE I- MID SOUTH TERM	10/29/93	PGC		JJB		MBCI	KENNTH MADDOX	Proc	
2160-003	McAlister Construction	09/16/91	SPV		SPV		MCAL	Mr. Ren Freeland	Proc	11/04/91
2039-013	Magic Valley Ford	08/09/91	CPG		BJJ		MCDONL	Mr. Bob McLean	Proc	07/14/92
2039-014	Ideal Chemical	08/23/91	CPG		BJJ		MCDONL	Mr. Bob McLean	Proc	07/20/92
2039-015	Implement Sales	02/28/92	CPG		SPV		MCDONL	Renee Castle	Proc	05/30/92
2230-001	Wilder Property Phase I	01/07/92	CPG		SPV		MCWATR		Proc	02/26/92
1006-002	Miscellaneous Services	07/16/89			CPG		MEMDRM	Mr. David Wingard	Proc	05/24/93
2156N001	Household HW Study	01/31/91	DJM		DJM		METRO	Ms. Diane Wiles	Proc	09/19/91
2293-001	EXIT 66 TRUCK STOP	09/22/93	SPV		HLJ		MIDCON	MR. MARVIN SHOEMAKER	Proc	
2181-001	Midway Ford Assessment	08/12/91	CPG		WCA		MIDWAY		Proc	10/20/92
2181-002	Septic Sampling	09/06/91			WCA		MIDWAY	Mr. Bill Russel	Proc	07/30/93
2217-001	Jackson, Tn.	05/01/92	CPG		SPV		MIGHTY	Kenneth Voelker	Proc	07/21/92
2081-002	Milan NPDES Permit Appl.	04/09/91	CPG		LRL		MILAN	Billy Blaylock	Proc	10/23/91
2059-003	UST-Investigation	05/10/91	SPV		SPV		MODINE	Steve Leahy	Proc	08/12/91
2059-004	UST REMOVAL	04/20/92	CPG		SPV		MODINE	GENE DILL	Proc	08/05/92
2059-005	SITE ASSESSMENTS	11/17/92	SJN		SPV		MODINE	TOM MEITNER	Proc	03/16/93
2229-001	WASTEWATER	09/14/92	CPG		CPG		MSCARR	MICHAEL HUFNAGEL	Proc	11/23/92
2286-001	UST REVIEW	09/02/93	CPG		BJJ		MSSMIT	MR. SEAN McGOWAN	Proc	10/15/93
2182-003	Refresher Course	01/31/92	DJM		BRC		NASHVI	Jim Downing	Proc	
2202-001	UST	01/11/92	CPG		SPV		NATION	Maury Knowlton	Proc	01/14/93
2202-002	STORMWATER	09/14/92	CPG		LRL		NATION	MAURY KNOWLTON	Proc	09/07/93
2202-003	SPCC	10/05/92	CPG		LRL		NATION	MAURY KNOWLTON	Proc	06/24/93
2202-004	DISCHARGE AGREEMENT	10/05/92	CPG		LRL		NATION	MAURY KNOWLTON	Proc	05/21/93
2202-005	EAR/CAP	11/17/92	CPG		SPV		NATION	MAURY KNOWLTON	Proc	09/30/93
2202-006	STORMWATER MONITORING	08/14/93	CPG		LRL		NATION	MR. JIM DUKE	Proc	09/22/93
2026-001	STORMWATER PERMITTING	08/18/92	DJM		PDW		NATPEN	LENDELL FITZGERALD	Proc	
2292-001	PHASE I, BURGER KING	09/22/93	CPG		WPJ		NETWOR	MR. JERRY FELDMAN	Proc	09/24/93
2240-001	SPILL RESPONSE COURSE	01/15/93	CPG		BRC		NOAA	MR. SAM HIGUCHI	Proc	07/30/93
2197-001	Dunns Transmission	12/31/91	SJN		BJJ		NORFLE	JJB	Proc	02/21/92
2207-001	Sherman Phase I	02/10/92			WCA		NWSHER		Proc	01/23/93
1025-006	Unbudgeted Tar Lk Expens	07/20/89			CPG		PARAMT	Mr. David Tripp	Proc	03/16/93
1025-007	NEGOTIATION- TAR LAKE	12/05/92	CPG		WCA		PARAMT	Mr. David Tripp	Proc	02/26/93
1025-008	TAR LAKE RCRA	12/10/92	CPG		AMR		PARAMT	Mr. David Tripp	Proc	10/15/93
2237-001	PARAMOUNT AMUSEMENT PARK	01/09/93	CPG		PDW		PARCOM	MS. ELISA M. RIVLIN	Proc	10/07/93
2237-003	MISC. SERVICES	01/20/93	CPG		PDW		PARCOM	MR. JIM MORAN	Proc	11/02/93
2237-004	RCRA TRAINING	04/08/93	CPG		PDW		PARCOM	MS. ELISA M. RIVLIN	Proc	11/02/93
2237-005	COMPLIANCE SERVICES	04/19/93	CPG		PDW		PARCOM	MS. ELISA M. RIVLIN	Proc	11/02/93
2237-006	CAROWINDS SOIL SAMPLING	07/15/93	CPG		PDW		PARCOM	MS. ELISA M. RIVLIN	Proc	09/30/93
2247-001	PARKRIDGE MALL PHASE I	02/22/93	CPG		MSO		PARKRI	MS. MARY E. RIESMEYER	Proc	03/30/93

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2261-001	LANDFILL CLOSURES	04/28/93	CPG		PDW		PARREA	MR. JIM MORAN	Proc	10/15/93
2261-002	UST CLOSURES-BRISTOL	04/29/93	CPG		PDW		PARREA	MR. JIM MORAN	Proc	08/27/93
2261-003	WKBD AUDIT	05/20/93	CPG		LRL		PARREA	MR. JIM MORAN	Proc	10/15/93
2261-004	WKBD PHASE II	06/07/93	CPG		LRL		PARREA	MR. JIM MORAN	Proc	08/27/93
2261-005	UST CLOSURES-INDY	07/13/93	CPG		PDW		PARREA	MR. JIM MORAN	Proc	06/25/93
2261-007	PHASE Is- 4 BUILDINGS	08/14/93	CPG		WCA		PARREA	MR. JIM MORAN	Proc	10/15/93
2261-008	GROSHA PHASE I	09/08/93	CPG		CPG		PARREA	MR. JIM MORAN	Proc	
2261-009	KINGS DOMINION REVIEW	10/21/93	PGC		DWP		PARREA	MR. JIM MORAN	Proc	
2261-010	WKBD- UST REVIEW	10/21/93	PGC		DWP		PARREA	MR. JIM MORAN	Proc	
2256-001	PEER REVIEW	03/23/93	CPG		SPV		PATTON	MR. RUSS RANDLE	Proc	08/31/93
1001-002	Miscellaneous Services	07/16/89	CPG		CPG		PLOUGH	Mr. John Addison	Proc	01/22/92
1001-012	DOT Training Courses	08/05/89	CPG		BRC		PLOUGH	Mr. Bob Gasper	Proc	03/29/93
1001-017	DOT Services	06/11/90	CPG		BRC		PLOUGH	Bob Gasper	Proc	08/10/93
1001-022	DIRT PILE SAMPLING	07/02/93	WCA		PGT		PLOUGH	MR. RAMADAS KINI	Proc	07/30/93
1001-023	CAP CONSTRUCTION SUPPORT	09/13/93	WCA		WCA		PLOUGH	MR. KENNY OSTROM	Proc	10/15/93
2134-001	Environmental Assessment	08/23/91	DJM		PDW		PMF	Glenn H. Falck	Proc	01/24/92
2143-001	Mr. Pride Tanks	11/30/90	SPV		SPV		PULLER	J.D. Puller	Proc	07/22/91
2266-001	EPCRA	05/12/93	CPG		LRL		QOCHEM	MR. WENDELL VAN HORN	Proc	07/20/93
2155N001	Environmental Assessment	01/31/91	DJM		DJM		REPUB	Donald B. Hauk	Proc	04/03/91
2155N002	Environmental Services	09/20/91	DJM		PDW		REPUB	Donald B. Hauk	Proc	01/14/92
2155N003	PREPURCHASE ASSEEEMENTS	06/30/93	DJM		PDW		REPUB	Donald B. Hauk	Proc	11/02/93
2048-004	Hwy 61 & Raines	05/24/91	CPG		SPV		RFS	Mike Pascal	Proc	10/14/91
2048-005	West Memphis, Phase II	05/24/91	CPG		SPV		RFS	Mike Pascal	Proc	07/30/93
2048-006	Hwy 61/Raines Rd. II	11/18/91	CPG		SPV		RFS	Mike Pascal	Proc	03/23/93
2048-008	HWY. 61 /RAINES	11/30/92	CPG		SPV		RFS	Mike Pascal	Proc	03/1
2048-009	WEST MEMPHIS	01/27/93	CPG		SPV		RFS	Mike Pascal	Proc	07/30/93
2048-010	PSA I	04/10/93	CPG		LRL		RFS	Mike Pascal	Proc	05/28/93
2048-011	PHASE II ASSESSMENTS	05/06/93	CPG		LRL		RFS	Mike Pascal	Proc	10/06/93
2048-012	ASBESTOS SURVEY	07/01/93	CPG		LRL		RFS	Mike Pascal	Proc	11/03/93
2048-013	PHASE I	08/25/93	CPG		WPJ		RFS	Mike Pascal	Proc	10/18/93
2048-014	LAFAYETTE.LA.	09/20/93	PGC		PJW		RFS	Mike Pascal	Proc	
2048-015	COMFORT INN, MARIETTA,GA	10/23/93	PGC		PJW		RFS	Mike Pascal	Proc	
2086-002	GEN. ENV. SERVICES	08/18/92	DJM		DJM		RHONE	TOM MIRABITO	Proc	03/08/93
2086-003	RISK/MODELING	10/28/92	DJM		DJM		RHONE	Mr. Tom Mirabito	Proc	05/19/93
2032-001	Brantley Landfill	07/16/89			GGL		RUMAGE	Waheed Khan	Proc	10/15/93
2032-002	Fort Hartford Mine	07/16/89			GGL		RUMAGE	Waheed Khan	Proc	10/15/93
2032-003	SOURCE CHAR. STUDY	04/19/93	SJN		GGL		RUMAGE	Mr. Terry Smith	Proc	10/15/93
2032-099	LITIGATION SUPPORT	03/11/93	SJN		WMA		RUMAGE	Mr. Terry Smith	Proc	10/27/93
2232-001	TRAINING	09/14/92	SJN		BRC		RUST	MARK RUST	Proc	07/07/93
2264-001	RUST OF KENTUCKY	05/06/93	SJN		LRL		RUSTKY	MR. JIMMY PHELPS	Proc	07/07/93
2257-001	QU. HOLL.-HAZ. WASTE REM	03/23/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	07/30/93
2257-002	QU. HOLLOW: CLOSURE PLAN	03/23/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	08/27/93
2257-003	CEDAR RIDGE LANDFILL	04/08/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	10/15/93
2257-004	QUAIL HOLLOW PLANNING	05/17/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	10/15/93
2257-005	CEDAR RIDGE WELL INSTALA	08/27/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	10/15/93
2257-006	QUAIL HOLLOW- HYDROGEOLG	09/08/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	10/15/93
2257-007	QUAIL HOLLOW LFILL DESIG	11/04/93	DJM		SNB		SANIFL	MR. JIM LEIPER	Proc	
1040-003	Kings Bay Design	07/02/89	SJN		SJN		SDIV	-	Proc	06/07/91
1040-020	Key West Contingency Pln	07/25/89	CPG		CPG		SDIV		Proc	
2204-001	MIDWAY FORD	01/22/92	CPG		WCA		SHAD	MIKE SHAD	Proc	03/13/92

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2227-001	HVAC Inspection	07/31/92	BRC		BJH		SHARP	BJH	Proc	05/14/93
2221-002	UST REMOVAL	08/28/92	CPG		WCA		SIGNAL	Mr. Walter Forbes, Jr.	Proc	05/12/93
2221-005	SOIL DISPOSAL	01/19/93	CPG		WCA		SIGNAL	Mr. Walter Forbes, Jr.	Proc	05/12/93
2221-006	SALE OF BUSINESS SUPPORT	03/17/93	CPG		WCA		SIGNAL	Mr. Walter Forbes, Jr.	Proc	07/20/93
2221-007	CORRECTIVE ACT. IMPLEME	04/02/93	CPG		WCA		SIGNAL	Mr. Walter Forbes, Jr.	Proc	10/15/93
2221-008	SYSTEM O & M	10/29/93	CAW		JES		SIGNAL	Mr. Walter Forbes, Jr.	Proc	
2221-009	GROUNWATER MONITORING	10/25/93	CAW		JES		SIGNAL	Mr. Walter Forbes, Jr.	Proc	
2203-001	Phase I	01/13/92	CPG		PDW		SIMMON	Steve Bestman	Proc	06/08/92
2203-003	ENVIRONMENTAL SITE ASSES	04/02/92	CPG		PDW		SIMMON	Steve Bestman	Proc	06/25/92
2259-001	ENVIRONMENTAL AUDIT	04/13/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	06/25/93
2259-003	NORTH ANDOVER, MASS	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	07/30/93
2259-004	MASSILLON, OH	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-005	IRWINDALE, CA	06/21/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	07/30/93
2259-006	CARLSBAD, CA	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	10/15/93
2259-007	BARTLETT, TN.	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-008	FRANKLIN PARK, ILL	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	08/27/93
2259-009	MENOMONEE FALLS, WI	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-010	EL PASO, TEXAS (MEXICO)	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-011	TUTTLINGEN, GERMANY	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-012	ORTHEZ, FRANCE	06/23/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-013	PONTOTOC, MS.	06/30/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	09/24/93
2259-014	MASILLON, OH (2)	06/30/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	08/27/93
2259-015	MONTREAL, QUEBEC	06/30/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	07/30/93
2259-016	OKLAHOMA CITY, OK	06/30/93	CPG		LRL		SMITH	MS. REBA ROBINSON	Proc	10/15/93
73-017	Jacksonville Closure Pln	07/16/89			SJN		SODIV	_	Proc	
1073-041	Health-Based Criteria	05/20/91	SJN		SJN		SODIV	_	Proc	
1093-001	Kings Bay Contingency Pl	07/17/89	CPG		BRC		SOUDIV	_	Proc	08/26/93
1093-002	Jacksonville Conting Pln	07/17/89	CPG		CPG		SOUDIV	_	Proc	
1093-004	New Orleans	08/21/89	CPG		BRC		SOUDIV	_	Proc	
1093-005	NSC Jax. Conting. Plan	08/23/89	CPG		BRC		SOUDIV	_	Proc	
1093-009	NAVHOSP Beaufort C.P.	10/03/90	CPG		BRC		SOUDIV	_	Proc	
1093-010	MCLB Albany Cont. Plan	10/03/90	CPG		BRC		SOUDIV	_	Proc	
2274-001	TIER II FORMS	06/25/93	LRL		MSD		SPECIA	SANDRA D. MACLIN	Proc	10/01/93
2158N003	Delta Project Phase II	03/21/91	DJM		DJM		SPROT2	Shirley Boettcher	Proc	10/15/93
2158N004	Stormwater Permits	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	09/30/93
2158N005	UST, Bldg. 74, Muncy	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	04/06/93
2158N006	Die Cell, Muncy	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N007	UST, Bldg. 66, Muncy	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N008	UST, Bldg. 81, Muncy	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N009	UST, Bldg. 67, Muncy	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	04/29/92
2158N010	UST's & Etc. Plant 2 Mun	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N011	UST & Etc., Creve	04/18/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N012	PCB's & Etc. Springfield	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	04/06/93
2158N014	OASHSS plans, all plants	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	05/20/93
2158N015	H/W Reporting, all plant	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N016	Asbestos surveys, all pl	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	01/27/92
2158N017	Waste minimization, all	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	12/09/92
2158N018	H/W Accumulat. areas, all	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	01/19/92
2158N019	A/P Equipment, all plant	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	
2158N020	Full site invest.-Muncy	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93

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2158N022	Aerial photos, Muncy	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	
2158N023	Offsite activites-Muncy	04/19/91	DJM		DJM		SPROUT	Earl Tressler	Proc	11/02/93
2158N024	X-Former	08/13/91	DJM		DJM		SPROUT	Earl Tressler	Proc	01/29/92
2158N025	Noise Study	10/16/91	DJM		DJM		SPROUT	Earl Tressler	Proc	12/30/91
2158N026	TRAINING	03/10/92	DJM		DJM		SPROUT	Earl Tressler	Proc	12/09/92
2158N027	KOPPERS LITIGATION	05/18/92	DJM		DJM		SPROUT	Mr. Earl Tressler	Proc	06/16/93
2158N028	SHERBROOKE-COMPLIANCE	09/24/93	DJM		DJM		SPROUT	Mr. Earl Tressler	Proc	11/02/93
2245-001	HERNANDO PHASE I	02/06/93	SJN		MSD		STAR	MR. MATT POLKA	Proc	03/23/93
2172-001	Panama City, FL	05/17/91			BJJ		STJUDE		Proc	06/14/91
2172-002	Cape Canaveral, FL	05/24/91			BJJ		STJUDE	Trina Taylor	Proc	07/15/91
2172-003	Stoddard, NH	08/14/91	CPG		BJJ		STJUDE	Robin Page	Proc	01/13/92
2172-004	Bernie, MO	08/26/91	CPG		BJJ		STJUDE		Proc	01/13/92
2172-006	HONEYBROOK, PA	04/30/92	CPG		BJJ		STJUDE		Proc	06/15/92
2172-008	505 N. PARKWAY	02/22/93	CPG		BJJ		STJUDE	MS. TRINA OWENS	Proc	04/29/93
2172-009	PHASE I - MARIA	06/22/93	CPG		BJJ		STJUDE		Proc	08/25/93
2172-010	GREENWOOD	09/09/93	CPG		LRL		STJUDE	MS. ROBIN PAGE	Proc	10/15/93
2263-001	PCB-ROCHESTER	05/04/93	CPG		BJH		SYBRON	MR. STEPHEN TOMASSI	Proc	10/15/93
2281-002	EXTENDED PSA I	09/08/93	CPG		LRL		SYBRON	MS. KELLY SCOTT	Proc	10/15/93
0001-100	Yearly Retainer	07/16/89	CPG		LRL		TAYLOR	Ms. Nancy Leonetti	Proc	05/08/90
0001-102	P.O. 03-025566 Testing	07/13/90	CPG		CPG		TAYLOR	Ms. Nancy Leonetti	Proc	08/22/90
0001-103	Alpine South-Yearly Ret	05/08/91	CPG		CPG		TAYLOR	Ms. Nancy Leonetti	Proc	
0001-104	Site Assessment	05/17/91	CPG		BJJ		TAYLOR	Ms. Nancy Leonetti	Proc	09/05/91
0001-105	STORMWATER PERMITTING	09/14/92	CPG		CPG		TAYLOR	Ms. Nancy Leonetti	Proc	02/12/93
0001-106	SPCC PLAN	11/05/92	CPG		LRL		TAYLOR	Ms. Nancy Leonetti	Proc	07/07[illegible]
0001-107	STORMWATER PERMITTING	09/01/93	CPG		LRL		TAYLOR	Ms. Nancy Leonetti	Proc	10/1
1056-002	Tampa, FL	07/16/89	CPG		BME		TERMX	Bill Wainscott	Proc	10/06/93
1056-008	Harrisburg, PA	09/19/89	CPG		BME		TERMX	Bill Wainscott	Proc	01/28/93
1056-009	Brookfield	02/26/90	CPG		BME		TERMX	Bill Wainscott	Proc	07/30/93
1056-010	Duncan	03/08/90	CPG		BME		TERMX	Bill Wainscott	Proc	10/09/91
1056-011	Ludlow	03/23/90	CPG		BME		TERMX	Bill Wainscott	Proc	04/03/91
1056-012	Environmental Services	06/14/90	CPG		BME		TERMX	Bill Wainscott	Proc	11/01/93
1056-013	Phoenix Site	02/14/91	CPG		BME		TERMX	Bill Wainscott	Proc	02/26/93
1056-014	AB & P Case	02/22/91	CPG		CPG		TERMX		Proc	02/12/93
1056-015	Salt Lake City	05/24/91	CPG		BME		TERMX	Bill Wainscott	Proc	10/30/91
1056-016	Clearwater-ARAB	07/12/91	CPG		BME		TERMX	Bill Wainscott	Proc	06/23/93
1056-022	Waste Reduction Plans	11/05/91	WCA		BTM		TERMX	Bill Wainscott	Proc	04/24/92
1056-024	1/92 Waste Disposal	01/14/92	CPG		BME		TERMX	Bill Wainscott	Proc	03/30/93
1056-025	Trugree-Portage, MI	02/05/92	CPG		BME		TERMX	Bill Wainscott	Proc	06/15/92
1056-026	PROJECT OHIO	03/03/92	CPG		BME		TERMX	Bill Wainscott	Proc	10/26/92
1056-027	JACKSONVILLE	03/17/92	CPG		BME		TERMX	Bill Wainscott	Proc	07/02/93
1056-028	AUDOBON, PA	05/19/92	CPG		BME		TERMX	Bill Wainscott	Proc	08/27/92
1056-030	CHEMLAWN-UST CLOSURES	09/15/92	CPG		BME		TERMX	Bill Wainscott	Proc	11/09/92
1056-031	TRUGREEN WHEAT RIDGE	12/10/92	CPG		BME		TERMX	Bill Wainscott	Proc	03/03/93
1056-032	MOUNTAIN VIEW , ARIZONA	02/10/93	CPG		BME		TERMX	Bill Wainscott	Proc	10/06/93
1056-033	TRUGREEN- FLINT UST	03/12/93	CPG		BME		TERMX	Bill Wainscott	Proc	06/16/93
1056-034	chemlawn-memphis	04/16/93	WCA		LAR		TERMX	Bill Wainscott	Proc	10/27/93
1056-035	MARK ANDY FLOOD	07/22/93	CPG		BRC		TERMX	Bill Wainscott	Proc	10/15/93
1056-036	PORT-A-FAB FLOOD	08/25/93	CPG		BJH		TERMX	Bill Wainscott	Proc	09/27/93
1056-037	OSHA AND DOT REVIEW	09/24/93	CPG		BRC		TERMX	Bill Wainscott	Proc	11/01/93
1056-038	TRUGREEN-NORWALK	10/29/93	PGC		MEB		TERMX	Bill Wainscott	Proc	

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1056-039	BIRMINGHAM	10/29/93	PGC		MEB		TERMX	Bill Wainscott	Proc	
2182-002	INHTRA	01/08/92	CPG		BRC		TERMX	Bill Wainscott	Proc	
2036-001	GERMANTOWN CABLE TV	11/17/92	CPG		BJJ		TIMEWR	MR. DAVID O'HAYRE	Proc	03/03/93
2216N001	ENVIRONMENTAL SERVICES	03/13/92	DJM		PDW		TTC	John Rave	Proc	05/12/93
2216N002	INTERIM MEASURES	03/26/93	DJM		PDW		TTC	John Rave	Proc	
2185-001	InDoor Air Evaluation	09/03/91			BRC		TURLEY	Ms. Jennifer McCraw	Proc	10/25/91
2150-001	MEDART Survey	01/09/91	SPV		SPV		UNION	Mr. Jim House	Proc	11/26/91
2150-011	PHASE I-BELLE MEADE	05/27/92	CPG		BJJ		UNION	MR. KENNETH PLUNK	Proc	08/25/92
2150-013	PHASE I-GREEN HILLS	05/27/92	CPG		BJJ		UNION	MR. KENNETH PLUNK	Proc	08/25/92
2150-014	PHASE I- HICK. HOLLOW	05/27/92	CPG		BJJ		UNION	MR. KENNETH PLUNK	Proc	08/25/92
2150-015	PHASE I- DONELSON	05/27/92	CPG		BJJ		UNION	MR. KENNETH PLUNK	Proc	08/25/92
2135-001	LaRoche Industries Inc.	10/26/90	CPG		SPV		USS	D.W. Brochstein	Proc	10/26/93
2282-001	CONSULTING	08/07/93	WCA		WCA		VALLEY	Mr. Jim Breazeale	Proc	10/15/93
2282-002	PREPARE RI/FS WORKPLAN	08/25/93	WCA		WCA		VALLEY	MR. JAMES BREAZELE	Proc	10/15/93
2288-001	TITLE V AIR PERMIT REVIE	09/08/93	CPG		LRL		VENDAS	MR. CAL EDLIN	Proc	
2287-001	PROGRESSIVE FOODS PSA I	09/08/93	CPG		CPG		VITA	MR. BUDDY FELDMAN	Proc	
2271-001	ALAMO SITE	05/20/93	CPG		BWD		VOLUNT	MR. BENNY McGEE	Proc	08/16/93
3000-001	USTs	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	09/07/93
3000-002	AIR QUALITY	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	06/02/93
3000-003	WASTEWATER	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	09/07/93
3000-004	STORMWATER	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	07/20/93
3000-005	SOIL CONTAMINATION	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	
3000-006	ASBESTOS	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	08/28/92
3000-007	SOLID AND HAZ. WASTE	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	
3000-008	HAZARDOUS MATERIALS PRO.	07/20/92	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	03/05/93
3000-012	SOUND LEVEL SURVEY	08/25/93	CPG		BJH		VVP	MR. BILL MINDERMAN	Proc	09/24/93
3000-013	WASTEWATER- HICKORY, NC	09/02/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	09/24/93
3000-014	USTs-GREENVILLE, SC	09/02/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	10/15/93
3000-015	USTs- SUPER SKY	09/02/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	
3000-016	USTs- SANTA CLARA, CA	09/02/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	10/18/93
3000-017	USTs- RICHMOND, VA	09/02/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	10/18/93
3000-018	USTs- VIRGINIA BEACH, VA	09/02/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	
3000-019	WASTEWATER-SANTE FE,CA	09/08/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	10/15/93
3000-020	GREENVILLE, SC PHASE I	09/24/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	
3000-021	UST- CLARKSVILLE, TN	09/27/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	10/15/93
3000-022	SUPER SKY PROD. NOISE SV	11/04/93	CPG		BJJ		VVP	MR. BILL MINDERMAN	Proc	
2253-001	WOOD STOVE AIR EMISSIONS	03/08/93	SJN		AEK		WALKER	MR. JERRY WALKER	Proc	05/11/93
2070-001	SCOTT PROPERTY	08/10/92	DJM		HCT		WALLER	JAMES M. WEAVER	Proc	10/30/92
2070-003	ABI LANDFILL	07/15/93	DJM		SNB		WALLER	JAMES M. WEAVER	Proc	
2070-004	CRUTCHFIELD AVE	07/30/93	DJM		MAG		WALLER	JAMES M. WEAVER	Proc	08/27/93
2029-001	NIXON DIESEL	08/29/92	DJM		DJM		WARD	BEN E. WARD	Proc	02/02/93
2174-001	Phase I-Germantown Pkwy	06/11/91	CPG		SPV		WENCO	Paul Dorman Jr.	Proc	07/12/91
2174-003	Shelby Drive	02/10/92	CPG		SPV		WENCO		Proc	12/28/92
2205-001	Shelby Drive	02/10/92	CPG		SPV		WENCO	Paul Dorman, Jr.	Proc	
2163-001	DOT Services	03/13/91			BRC		WESLEY	J. Chris Kent	Proc	05/06/91
2272-001	PEER REVIEW	06/07/93	SPV		SPV		WEYERH	MR. JESS WALRATH	Proc	10/27/93
2272-002	DeQueen Proj. Mgmt.	10/29/93	PGC		PVS		WEYERH	MR. JESS WALRATH	Proc	
2272-003	DeQueen Wastewater	11/05/93	PVS		PVS		WEYERH	MR. JESS WALRATH	Proc	
2037-001	COLLIER WIRE UST	11/24/92	SJN		SSA		WICKAM	JIM BOGGS	Proc	06/16/93
1046-004	Miscellaneous Services	07/20/89			CPG		WICKES	Mr. Jim Boggs	Proc	09/15/93

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1046-008	MANCELONA GW STUDY	05/08/92	CPG		SPV		WICKES	Mr. Jim Boggs	Proc	07/21/92
1046-009	IMPACT WORK PLAN/REMOVAL	09/28/93	WCA		SSA		WICKES	Mr. Jim Boggs	Proc	
2061-002	Indian Hills Remediation	04/19/91			SPV		WILBN		Proc	05/28/93
2278-001	AIR PERMIT APPLICATION	07/12/93	CPG		AEK		WRIGHT	MS. ANN INCE	Proc	08/31/93
2278-002	AIR PERMITS	09/17/93	PGC		PMD		WRIGHT	MS. ANN INCE	Proc	10/15/93

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APPENDIX A

LITHOLOGIC LOGS

(Source: Reference 12)

LITHOLOGIC LOG OF WELL CP-1

Description	Depth (ft)	Thickness (ft)
Clay, slightly sandy, light tan to gray...	0 - 10	10
Clay, gray, soft, with organic debris and a trace of fine sand......................	10 - 15	5
Sand, stiff, gray, with a trace of clay and scattered shell fragments.............	15 - 23	8
Clay, soft, calcareous, brownish-gray.....	23 - 25	2

LITHOLOGIC LOG OF WELL CP-2

Description	Depth (ft)	Thickness (ft)
Clay, slightly sandy, tan.................	0 - 3	3
Clay, sandy, very stiff, grayish-tan......	3 - 10	7
Clay, plastic, gray, with a trace of silt.	10 - 15	5
Clay, sandy, soft, gray...................	15 - 21.5	6.5
Clay, stiff, calcareous, slightly sandy, grayish-green.............................	21.5 - 25	3.5

LITHOLOGIC LOG OF WELL CP-3

Description	Depth (ft)	Thickness (ft)
Clay, slightly sandy, tan to reddish-brown...................................	0 - 2	2
Sand, fine-grained, slightly clayey, dark gray to black............................	2 - 8	6
Clay, plastic, gray, with a trace of silt.	8 - 14	6
Clay, slightly sandy, stiff, gray, scattered shell fragments................	14 - 18.5	4.5
Clay, calcareous, soft, slightly sandy, brownish-green............................	18.5 - 25	6.5

LITHOLOGIC LOG OF WELL CP-4

Description	Depth (ft)	Thickness (ft)
Clay, slightly sandy, medium stiff, tan...	0 - 2	2
Sand, fine-grained, gray, with a trace of clay and scattered small shell fragments..	2 - 8	6
Clay, soft, dark gray, with scattered decaying vegetable matter.................	8 - 18	10
Clay, medium stiff, gray, with scattered roots....................................	18 - 23	5
Sand, fine-grained, slightly clayey, tan......................................	23 - 25	2

LITHOLOGIC LOG OF WELL CD-1

Description	Depth (ft)	Thickness (ft)
Sand, medium-grained, with a trace of small shell fragments.....................	0 - 5	5
Clay, soft, gray, with laminations of fine sand....................................	5 - 10	5
Sand, medium grained, gray, with a trace of clay.................................	10 - 12	2
Clay, soft, gray, with laminations of fine sand and decaying wood..................	12 - 16.5	4.5

LITHOLOGIC LOG OF WELL CD-2

Description	Depth (ft)	Thickness (ft)
Clay, very soft, brown....................	0 - 5	5
Clay, very soft, green, with decaying vegetable matter.........................	5 - 15	10

LITHOLOGIC LOG OF WELL CD-3

Description	Depth (ft)	Thickness (ft)
Clay, stiff, tan, with a trace of sand and scattered roots...........................	0 - 4	4
Clay, soft, dark gray, with decaying wood fragments................................	4 - 10	6
Clay, very soft, gray, with decaying wood fragments and a trace of silt.............	10 - 11.5	1.5
Clay, very soft, dark gray................	11.5 - 15	3.5

LITHOLOGIC LOG OF WELL CD-4

Description	Depth (ft)	Thickness (ft)
Clay, stiff, tan, slightly sandy, with scattered roots...........................	0 - 4	4
Clay, soft, dark gray.....................	4 - 10	6
Clay, very soft, dark gray, with a trace of silt and scattered laminations of fine sand.....................................	10 - 14	4
Clay, calcareous, hard, brownish-green, with a trace of sand and fragments of decaying wood.............................	14 - 16.5	2.5

LITHOLOGIC LOG OF WELL CD-5

Description	Depth (ft)	Thickness (ft)
Clay, very soft, dark gray................	0 - 5	5
Sand, fine grained, slightly clayey, gray....................................	5 - 10	5

LITHOLOGIC LOG OF WELL LF-1

Description	Depth (ft)	Thickness (ft)
Sand, medium-grained, with gravel and a trace of clay..............................	0 - 8.5	8.5
Clay, very soft, dark gray, with scattered gravel and decaying vegetable matter......	8.5 - 16.5	8
Clay, very soft, gray.....................	16.5 - 25	8.5

LITHOLOGIC LOG OF WELL DLF-1

Description	Depth (ft)	Thickness (ft)
Fill - gravel, sand, debris	0 - 12	12
Clay, soft, gray, with a trace of sand....	12 - 20	8
Clay, soft, gray..........................	20 - 32	12
Clay, soft, gray, with a trace of sand and shell fragments..........................	32 - 45	13
Clay, hard, calcareous, slightly sandy, grayish-green	45 - 62	17

LITHOLOGIC LOG OF WELL LF-2

Description	Depth (ft)	Thickness (ft)
Sand, medium-grained, with gravel.........	0 - 5	5
Clay, very soft, gray.....................	5 - 11	6
Clay, very soft, dark gray, with decaying vegetable matter..........................	11 - 20	9

LITHOLOGIC LOG OF WELL LF-3

Description	Depth (ft)	Thickness (ft)
Fill - sand and gravel....................	0 - 4	4
Clay, calcareous, hard, dark green, with some sand and gravel......................	4 - 13	9
Clay, soft, dark gray....................	13 - 20	7
Clay, soft, dark gray, with a trace of sand and scattered shell fragments........	20 - 22	2
Sand, fine grained, clayey, dark gray, with fragments of decaying wood...........	22 - 25	3

LITHOLOGIC LOG OF WELL LF-4

Description	Depth (ft)	Thickness (ft)
Fill - gravel and sandy clay..............	0 - 7	7
Clay, soft, gray, with a trace of gravel..	7 - 15	8
Clay, soft, grayish-green, with scattered laminations of very fine sand.............	15 - 18.5	3.5
Clay, plastic, dark gray, with scattered shell fragments and pieces of decayed vegetable matter..........................	18.5 - 22	3.5
Clay, stiff, calcareous, green, with a trace of sand............................	22 - 25	3

LITHOLOGIC LOG OF WELL LF-5

Description	Depth (ft)	Thickness (ft)
Sand, fine grained, tan, with gravel and debris (fill)..............................	0 - 5	5
Gravel, clayey (fill).....................	5 - 13	8
Clay, soft, dark gray, with scattered pieces of decaying wood...................	13 - 21	8
Clay, soft, gray, with scattered shell fragments.................................	21 - 31	10

LITHOLOGIC LOG OF WELL LF-6

Description	Depth (ft)	Thickness (ft)
Clay, stiff, dark brown, with a trace of sand, wood, and gravel (fill).............	0 - 1.5	1.5
Clay, very soft, dark gray, with roots....	1.5 - 4	2.5
Clay, very soft, dark gray................	4 - 15	11

LITHOLOGIC LOG OF WELL LF-7

Description	Depth (ft)	Thickness (ft)
Sand, fine-grained, loose, brown, with gravel and wood (fill)....................	0 - 2.5	2.5
Sand, fine-grained, clayey, loose, dark gray to brown, with gravel and wood (fill)	2.5 - 7.5	5
Sand, fine-grained, loose, gray, with gravel (fill)............................	7.5 - 9	1.5
Clay, sandy, stiff, reddish-brown.........	9 - 11.5	2.5

LITHOLOGIC LOG OF WELL LF-8

Description	Depth (ft)	Thickness (ft)
Clay, stiff, dark gray, with gravel (fill)	0 - 1.5	1.5
Sand, wood and gravel, with brick fragments (fill)..............................	1.5 - 4	2.5
Clay, very soft, dark gray, with decaying vegetable matter.........................	4 - 9	5
Clay, very soft, dark gray, with scattered laminations of fine sand........	9 - 11.5	2.5
Clay, very soft, dark gray................	11.5 - 15	3.5

LITHOLOGIC LOG OF WELL LF-9

Description	Depth (ft)	Thickness (ft)
Sand, fine-grained, clayey, gray, with roots and gravel..........................	0 - 1.5	1.5
Clay, medium stiff, greenish-gray, with roots and a trace of sand.................	1.5 - 5	3.5
Clay, stiff, greenish-gray, with shell fragments and a trace of sand.............	5 - 11.5	6.5
Clay, soft, sandy, gray...................	11.5 - 14	2.5

LITHOLOGIC LOG OF WELL LF-10

Description	Depth (ft)	Thickness (ft)
Sand, fine-grained, clayey, loose, gray, with roots................................	0 - 1.5	1.5
Clay with gravel and brick fragments......	1.5 - 4	2.5
Sand, fine-grained, slightly clayey, gray, with pieces of wood......................	4 - 6.5	2.5
Clay, very soft, dark gray, with a trace of sand...................................	6.5 - 12.5	6

LITHOLOGIC LOG OF WPA-1

Description	Depth (ft)	Thickness (ft)
Sand, fine-grained, dark brown, with roots	0 - 4	4
Sand, fine-grained, slightly clayey, firm, orangish-brown...........................	4 - 7.5	3.5
Clay, stiff, slightly sandy, gray.........	7.5 - 9	1.5
Sand, fine-grained, firm, light gray, with a trace of clay......................	9 - 12.5	3.5
Clay, soft, dark gray, with a trace of sand...................................	12.5 - 15	2.5

LITHOLOGIC LOG OF WPA-2

Description	Depth (ft)	Thickness (ft)
Sand, fine-grained, orangish-brown, with scattered roots........................	0 - 4	4
Clay, sandy, stiff, orangish-brown........	4 - 6.5	2.5
Sand, fine-grained, clayey, firm, orangish-brown...........................	6.5 - 13	6.5
Clay, soft, dark gray.....................	13 - 14	1

LITHOLOGIC LOG OF WOC-1

Description	Depth (ft)	Thickness (ft)
Clay, sandy, medium stiff, dark gray to brown.....................................	0 - 1.5	1.5
Clay, very soft, dark gray, with roots....	1.5 - 6.5	5
Sand, fine to medium-grained, loose, gray, with shell fragments.....................	6.5 - 10	3.5

LITHOLOGIC LOG OF WOC-2

Description	Depth (ft)	Thickness (ft)
Sand, clayey, fine-grained, brown.........	0 - 1.5	1.5
Clay, soft, dark gray, with roots.........	1.5 - 6.5	5
Sand, loose, fine to medium-grained, gray, with thin layers of grayish-green clay and scattered shell fragments............	6.5 - 9	2.5
Sand, loose, fine to medium-grained, with scattered shell fragments................	9 - 10.5	1.5

LITHOLOGIC LOG OF WELL OPW-1

Description	Depth (ft)	Thickness (ft)
Fill - sand and gravel..................	0 - 2	2
Sand, slightly clayey, gray to brown......	2 - 3.5	1.5
Sand, fine-grained, tan, with scattered gravel..................................	3.5 - 5	1.5
Sand, fine-grained, dark gray to brown, with scattered debris - wood and bricks...	5 - 10	5

LITHOLOGIC LOG OF WELL OPW-2

Description	Depth (ft)	Thickness (ft)
Fill - very hard sand and gravel..........	0 - 2	2
Sand, slightly clayey, fine-grained, tan to brown................................	2 - 4	2

LITHOLOGIC LOG OF WELL OPW-3

Description	Depth (ft)	Thickness (ft)
Fill - sand and gravel....................	0 - 2	2
Sand, clayey, with gravel (fill)..........	2 - 5	3
Sand, fine to medium-grained, gray, with scattered shell fragments and a trace of clay....................................	5 - 8	3
Sand, fine to medium-grained, gray, with a trace of clay..........................	8 - 10	2

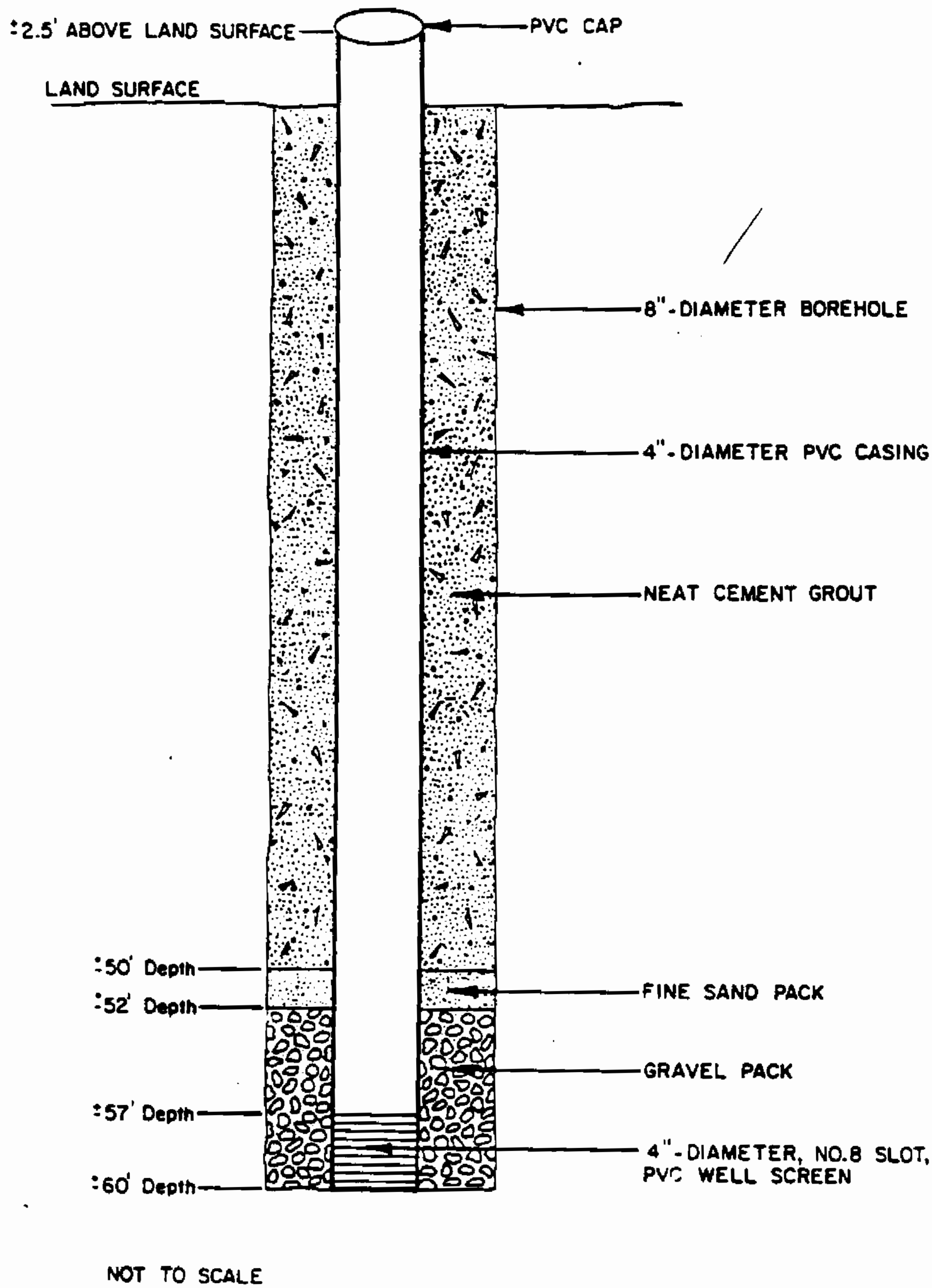


Figure 5. Construction Diagram of Monitor Well DLF-1.

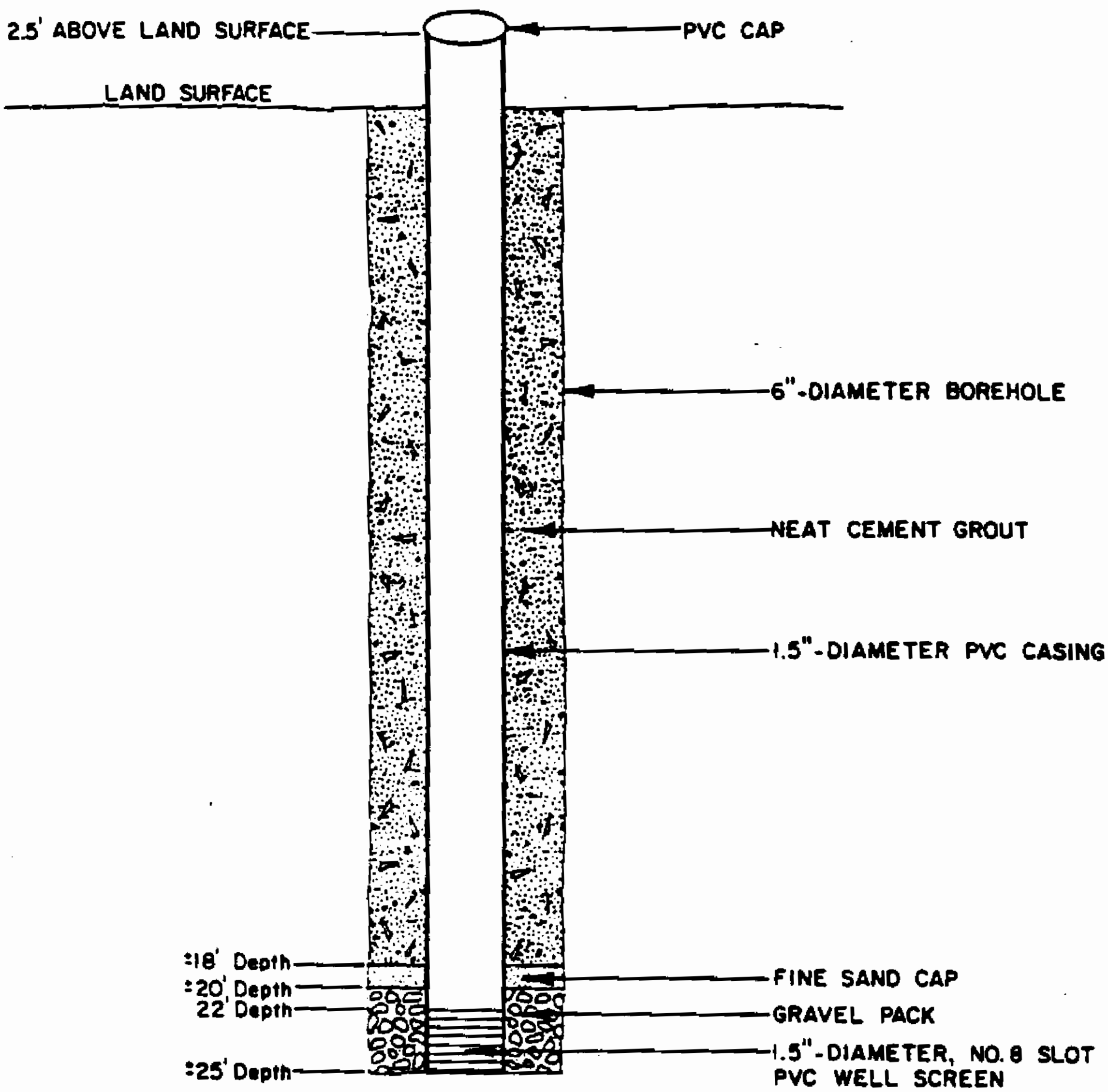


Figure 4. General Construction Diagram of a 1.5-Inch-Diameter Monitor Well.

Table 1 (Continued)

Well No. and Location	Total Depth (ft/bls)[1]	Screen Setting (ft/bls)	Gravel-Pack Setting (ft/bls)
SLF-1	8	5 - 8	3 - 8
SLF-2	8	5 - 8	3 - 8
DLF-1	62	60 - 57	50 - 62
Chemical-Disposal Area			
CD-1	16.5	12 - 15	10 - 16.5
CD-2	15	12 - 15	8 - 15
CD-3	15	12 - 15	8 - 15
CD-4	16.5	12 - 15	8 - 16.5
CD-5	10	7 - 10	4 - 10
Electrical Transformer Storage Area			
WOC-1	10	7 - 10	3 - 10
WOC-2	10.5	7.5 - 10.5	3 - 10.5

1) Feet below land surface.

TABLE 1. CONSTRUCTION DETAILS OF MONITOR WELLS

Well No. and Location	Total Depth (ft/bls)[1]	Screen Setting (ft/bls)	Gravel-Pack Setting (ft/bls)
Caustic-Pond Area			
CP-1	25	22 - 25	18 - 25
CP-2	25	17 - 20	14 - 25
CP-3	25	22 - 25	18 - 25
CP-4	25	22 - 25	18 - 25
Oil-Sludge Pit Area			
OPW-1	10	7 - 10	4 - 10
OPW-2	4	1 - 4	0 - 4
OPW-3	10	7 - 10	4 - 10
Pesticide-Mixing Area			
WPA-1	13	10 - 13	7 - 15
WPA-2	13	10 - 13	7 - 14
Landfill Area			
LF-1	25	22 - 25	18 - 25
LF-2	20	17 - 20	14 - 20
LF-3	25	22 - 25	18 - 25
LF-4	25	22 - 25	18 - 25
LF-5	31	27 - 30	22 - 31
LF-6	15	5 - 12	7 - 15
LF-7	11.5	7 - 10	4 - 11.5
LF-8	15	12 - 15	7 - 15
LF-9	14	11 - 14	6 - 14
LF-10	12.5	9.5 - 12.5	4 - 12.5

APPENDIX B

GEOTECHNICAL DATA

(Source: Reference 12)

Soil Consultants, Inc.
FOUNDATION & TESTING ENGINEERS
P.O. Drawer 698, Charleston, S.C. 29402
Phone (803) 723-4539

August 26, 1981

Geraghty and Miller, Inc.
Consulting Ground Water Geologists
and Hydrologists
P. O. Box 271173
Tampa, Florida 33688

RECEIVED
AUG 31 1981

Attention: Mr. Philip J. Ciaravella
Hydrogeologist

Re: Monitor Wells, U. S. Naval Station
Charleston, S. C.
SCI Project 81138

Gentlemen:

Enclosed you will find the below laboratory test reports on various tests recently completed on the undisturbed samples obtained from the above noted project.

At the time of our August 3, 1981, telephone discussion you indicated that you desired a consolidation test on Sample No. 1, Boring No. DLF-1. As noted on the Undisturbed Sample Characteristics this was not possible due to high sand content. In view of the similar depth of this sample and that of Sample No. 4, Boring No. LF-1, we performed several additional tests to provide you with as much information as possible due to the vast differences in these two samples.

DATA

Undisturbed Sample Characteristics	-	2 Sheets
Soil Mechanic Laboratory Data	-	1 Sheet
Consolidation Test (including calculated permeability)	-	2 Sheets

If we can be of further service, please call on us.

Sincerely,

SOIL CONSULTANTS, INC.

W. K. JOHNSON, P.E.
President

L. K. Himelright, P.E.
Senior Vice President

W. B. HAMILTON, P.E.
Secretary - Treasurer

J. E. DUFFY, P.E.

MATERIALS TESTING REPORT	SOIL CONSULTANTS, INC.	UNDISTURBED SAMPL CHARACTERISTICS

PROJECT and STATE Geragnty and Miller Inc., Tampa Florida
Monitor Wells, U. S. Naval Station, Charleston, S.C. (SCI 81138)

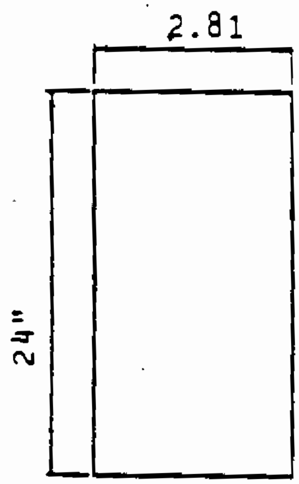
TESTED AT	APPROVED BY	DATE
SCI, Charleston, S. C.	[signature]	8-4-81

FIELD SAMPLE NO	DEPTH (ft) from	to	SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY N
1	20'0"	22'0"	Boring No. DLF-1	Pushed	81-141

COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (TSF)	VISUAL CLASSIFICATION (US
Dark Gray	Damp	Solid	Banded	Silty clay with very high sand content - numerous sand lenses.		

w 39.7 % γ_d 1.306

REMARKS



Numerous sand lenses and high sand content would not permit consolidation test. See Soil Mechanics Data Sheet for confirmation of SM Soil

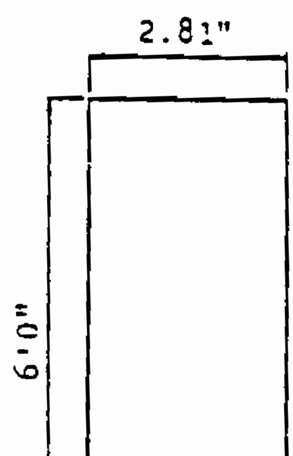
1/4" to 1/2" Dark gray silty clay

FIELD SAMPLE NO	DEPTH (ft) from	to	SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY NO
3	50'0"	52'0"	Boring No. DLF-1	Pushed	81-1410

COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (TSF)	VISUAL CLASSIFICATION (USC
Brownish Green (Marl)	Very moist	solid	Uniform	Clay and silt		

w 59.7 % γ_d 0.92

REMARKS



Consolidation Test

MATERIALS TESTING REPORT	SOIL CONSULTANTS, INC.	UNDISTURBED SAMPI CHARACTERISTICS

PROJECT and STATE Geragnty and Miller, Inc., Tampa Florida
Monitor Wells, U. S. Naval Station, Charleston, S. C. (SCT 81179)

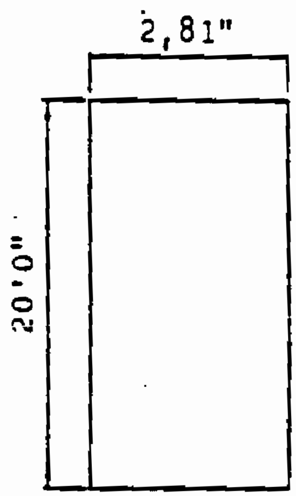
TESTED AT	APPROVED BY	DATE
SCI, Charleston, S. C.	[signature]	8-11-31

FIELD SAMPLE NO	DEPTH (ft) from	DEPTH (ft) to	SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY
4	60'0"	62'0"	Boring No. DLF-1	Pushed	81-14

COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (TSF)	VISUAL CLASSIFICATION
Brownish	Very moist	Solid	Uniform	Clay and		
Green				silt		
(Marl)						

ω 43.1 % γ_d 1.223 g/cc

REMARKS



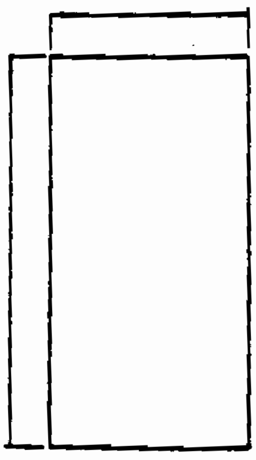
Consolidation Test and
Washed sieve analysis

FIELD SAMPLE NO	DEPTH (ft) from	DEPTH (ft) to	SAMPLE LOCATION	TYPE OF SAMPLE	LABORATORY

COLOR	RELATIVE MOISTURE	CONSISTENCY	POROSITY OR STRUCTURE	TEXTURE	POCKET PENETROMETER (TSF)	VISUAL CLASSIFICATION

ω ____ % γ_d ____ g/cc

REMARKS



ghty and Miller, Inc., Tampa Florida
tor Wells, U. S. Naval Station, Charleston, S. C.
(SCI 81138)

SOIL CONSULTANTS, INC.

SOIL MECHANICS LABORATORY DATA
Sheet 1 of 1

Lab No.	Field Number		Depth	Field Classification	Fines [illegible]	[illegible]	[illegible]	[illegible]	#200 .074	#100 .149	#60	#40	#20	#10	#4	3/8"	1/2"	3/4"	1"	1 1/2"	2"	LL	PL	Unified Classification	Dry Density	Moisture	Gs	Consolidation	Special Tests	
	1	Boring DLF-1	20'0" 22'0"						38.1	18.1	56.0	80.3	94.9	909	998		100					29.3 NF	18.4 NP	*	1306	39.7				
A	3	Boring DLF-1	50'0" 52'0"																						3926	69.7	[illegible]	X		
B	4	Boring DLF-1	60'0" 62'0"						67.4	77.9	93.5	97.4	99.0	996	100										1223	43.1	2649	X		
C	1	Boring LF 1	5'0" 6'6"						1.4	4.5	12.3	14.4	18.7	355	541		809	100												
D	2	Boring LF 1	10'0" 11'6"						2.7	3.4	4.1	5.1	8.6	206	382		658	722	100											
E	4	Boring LF 1	20'0" 21'6"						99.3	(Insufficient sample for further testing)																				

* represents the hand picked more clayey portion of this sample for additional information

(SCI 81138) Lab No. 81-14108

MATERIALS TESTING REPORT	SOIL CONSULTANTS, INC.	CONSOLIDATION TEST

PROJECT and STATE Geraghty and Miller Inc., Tampa Fla. Monitor Wells, U.S.Naval Sta., Charleston, SC	SAMPLE LOCATION Boring DLF-1

FIELD SAMPLE NO.	DEPTH	GEOLOGIC ORIGIN
3	50'0" to 52'0"	

TYPE OF SAMPLE	TESTED AT	APPROVED BY	DATE
Pushed	SCI-Charleston, SC		8-22-81

CLASSIFICATION (Marl)

G_s 2.660 LL ______ PI ______

INITIAL DENSITY γ_d 0.926

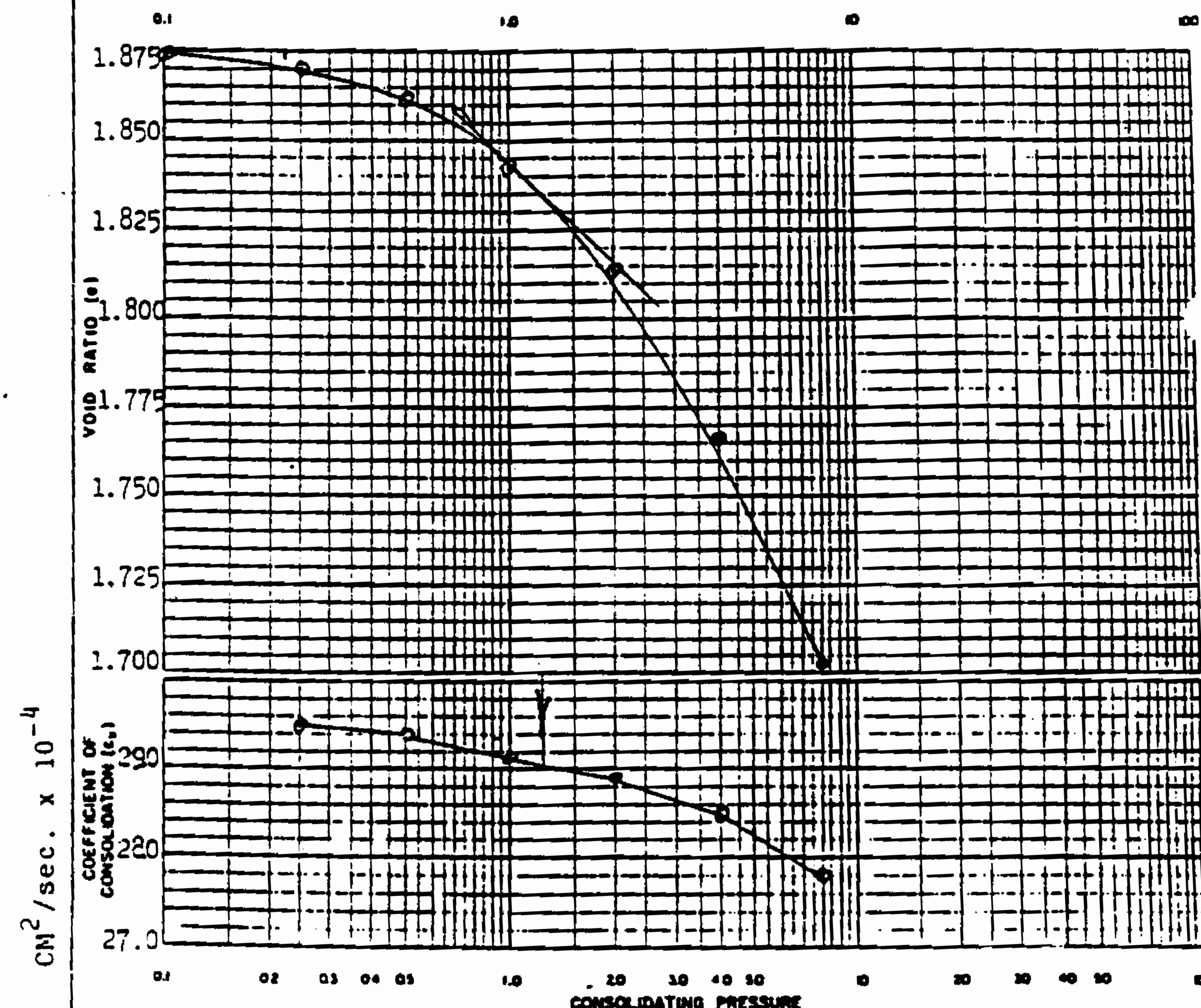
INITIAL VOID RATIO, e_0 1.874

COMPRESSION INDEX, C_c ______

TEST SPECIFICATIONS: MOISTURE CONTENT, %

START OF TEST	DEG. OF SAT. AT START OF TEST	END OF TEST
69.7	98.9	67.5

Flooded after loading to 110 KSF



REMARKS Drainage top and bottom
Sample 2.5" diameter, 1" thick
cc = 1.890 - 1.700 - 0.190
Permeability @ 1.25 KSF k = 13.5 x 10^{-5}

APPENDIX C

ACTION LEVEL SOURCE DATA

(Source: Reference 19, Appendices A through F)

develop and conduct these further Regulatory Impact Analyses.

The new analyses will be conducted in accordance with the existing Agency guidance on Regulatory Impact Analysis and the draft Regulatory Impact Analysis Guidance published in the 1988 Regulatory Program of the United States. The analyses will explicitly examine the costs, health and environmental benefits, and technological limitations for the key regulatory requirements contained in the proposal—especially for the several alternative approaches to ground water remediation outlined in the proposed rule. This analysis will also estimate the aggregate impacts, identified above, for sites eligible for remediation under this rule and for those sites which are listed on the NPL, and will, therefore, look to this rule as an ARAR, under the provisions of CERCLA. Upon completion of the revised analyses, EPA will solicit comment on the results of the analyses and the methodology used to derive them. The Agency will then assess these comments, along with comments which will have been received previously on the proposed rule. Through these actions EPA will ensure that the net social benefits (including environmental and health benefits) of the rule proposed today are maximized, taking into account costs, technological limitations, risks, and realistic assessments of both actual and reasonably expected uses of each site. If the revised RIA, together with the comments received, demonstrate that the rule proposed today does not achieve this outcome, the Agency will make appropriate modifications to the final rule, or if necessary, will repropose the rule.

B. Regulatory Flexibility Act

The Regulatory Flexibility Act requires Federal agencies to fully analyze the economic effects of regulations on small entities. The Agency analyzed the economic impacts for the regulatory options that are most similar to today's proposed rule (*i.e.*, "Immediate Cleanup to Health-Based Standards" and "Flexible Cleanup to Health-Based Standards").

The RIA assumes that a small business is significantly impacted if its excess of cash flow over ten percent of its total liabilities is insufficient to meet corrective action costs, or if its net income is insufficient to meet its corrective action costs.

For the alternative analyzed, it was found that small firms encounter more severe impacts from the corrective action requirements than large firms. The options most similar to the proposed rule result in incremental impacts (*i.e.*, relative to the baseline) on approximately 9 to 11 percent of small businesses owning RCRA facilities.

Based on the Agency's guidelines for implementing the Regulatory Feasibility Act, the results of the analysis as summarized above, suggest that the proposed rule does not impose significant impacts on small entities.

C. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq*. Reporting and recordkeeping burden on the public for this collection is estimated at 42,497 hours for the 674 respondents, with an average of 1,151 hours per response. (Burden estimates should include all aspects of the collection effort and may include time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, completing and reviewing the collection of information, *etc.*)

If you wish to submit comments regarding any aspect of the collection of information, including suggestions for reducing the burden, or if you would like a copy of the information collection request (please reference ICR #1451), contact Rick Westlund, Information Policy Branch, PM-223, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460 (202-382-2745); and Tim Hunt, Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

List of Subjects in 40 CFR Parts 264, 265, 270, and 271

Administrative practice and procedure, Corrective action, Hazardous waste: Insurance, Reporting and recordkeeping requirements.

Dated: July 5, 1990.

William Reilly,

Administrator.

XI. Supplementary Documents

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air (ug/m^3)	Water (mg/L)	Soils (mg/kg)
Acetone	D		4E−00	8E+03
Acetonitrile	D		2E−01	5E+02
Acetophenone	D	2E−01	4E−00	8E+03
Acrylamide	B2	8E−04	8E−08	2E−01
Acrylonitrile	B1	1E−02	6E−06	1E−00
Aldicarb	D		5E−02	1E+02
Aldrin	B2	2E−04	2E−08	4E−02
Allyl alcohol	D		2E−01	4E+02
Aluminum phosphide	D		1E−02	3E+01
Aniline	B2		6E−03	1E+02
Antimony	D		1E−02	3E+01
Arsenic	A	7E−06	(1)	8E+01
Asbestos (2)	A	2E−02		
Barium cyanide	D		2E−00	6E+03
Barium, ionic	D	4E−01	(1)	4E+03
Benzidine	A	2E−06	2E−07	3E−03
Beryllium	B2	4E−04	8E−08	2E−01
Bis(2-ethylhexyl)phthalate	B2		3E−03	5E+01
Bis(chloroethyl)ether	B2	3E−03	3E−06	6E-01
Bromodichloromethane (3)	B2		3E−06	5E−01
Bromoform (3)	D		7E−01	2E+03
Bromomethane	D	3E+01	5E−02	1E+02
Butyl benzyl phthalate	C		7E−00	2E+04

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS—Continued

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air(ug/m^3)	Water (mg/L)	Soils (mg/kg)
Cadmium	B1	6E−04	(1)	4E+01
Calcium cyanide	D		1E−00	3E+03
Carbon disulfide	D		4E−00	8E+03
Carbon tetrachloride	B2	3E−02	3E−04	5E−00
Chloral	D		7E−02	2E+02
Chlordane	B2	3E−03	3E−05	5E−01
Chlorine cyanide	D		2E−00	4E+03
Chlorobenzene	D	2E+01	7E−01	2E+03
Chloroform (3)	B2	4E−02	6E−03	1E+02
2-Chlorophenol	D		2E−01	4E+02
Chromium (VI)	A	9E−05	(1)	4E+02
Copper cyanide	D		2E−01	4E+02
m-Cresol	D		2E−00	4E+03
o-Cresol	D		2E−00	4E+03
p-Cresol	D		2E−00	40+03
Cyanide	D		7E−01	2E+03
Cyanogen	D		1E−00	3E+03
Cyanogen bromide	D		3E−00	7E+03
DDD	B2		1E−04	3E−00
DDE	B2		1E−04	2E−00
DDT	B2	1E−02	1E−04	2E−00
Dibutyl phthalate	D		4E−00	8E+03
Dibutylnitrosamine	B2	6E−04	6E−06	1E−01
3,3'-Dichlorobenzidine	B2		8E−06	2E−00
Dichlorodifluoromethane	D	2E+02	7E−00	2E+04
1,2-Dichloroethane	B2	4E−02	(1)	8E−00
1,1-Dichloroethylene	C	3E−02	(1)	1E+01
2,4-Dichlorophenol	D		1E−01	2E+02
2,4-Dichlorophenoxyacetic acid	D		4E−01	8E+02
1,3-Dichloropropene	B2		1E−02	2E+01
Dieldrin	B2	2E−04	2E−06	4E−02
Diethyl phthalate	D		3E+01	6E+04
Diethylnitrosamine	B2	2E−06	2E−07	5E−03
Dimethoate	D		7E−01	2E+03
Dimethylnitrosamine	B2	7E−06	7E−07	1E−02
m-Dinitrobenzene	D		4E−03	8E−00
2,4-Dinitrophenol	D		7E−02	2E+02
2,3-Dinitrotoluene (and 2,6-, mixture)	B2		5E−05	1E-00
1,4-Dioxane	B2		3E−03	6E+01
Diphenylamine	D		9E−01	2E+03
1,2-Diphenylhydrazine	B2	4E−03	4E−05	9E−01
Disulfoton	D		1E−03	3E−00
Endosulfan	D		2E−03	4E−00
Endothall	D		7E−01	2E+03
Endrin	D		(1)	2E+01
Epichlorohydrin	B2	8E−01	4E−03	7E+01
Ethylbenzene	D		4E-00	8E+03
Ethylene dibromide	B2	5E−03	4E−07	8E−03
Formaldehyde	B1	8E−02		
Formic acid	D		7E+01	2E+05
Glycidyaldehyde	D		1E−02	3E+01
Heptachlor	B2	8E−04	8E−06	2E−01
Heptachlor epoxide	B2	4E−04	4E−06	8E−02
Hexachlordibenzo-p-dioxin	B2	6E−07	1E−08	1E−04
Hexachlorobutadiene	C	4E−01	4E−03	8E+01
alpha-Hexachlorocyclohexane	B2	6E−04	6E−06	1E−01
beta-Hexachlorocyclohexane	C	2E−02	2E−04	4E−00
Hexachlorocyclopentadiene	D	7E−02	2E−01	5E+02
Hexachloroethane	C	3E−00	3E−02	6E+01
Hexachlorophene	D		1E−02	2E+01
Hydrazine	B2	2E−04	1E−05	2E−01
Hydrogen cyanide	D		7E−01	2E+03
Hydrogen sulfite	D		1E−01	2E+02
Isobutyl alcohol	D		1E+01	2E+04
Isophorone	C		9E−02	2E+03
Lead	B2		(1)	
Lindane (gamma-hexachlorocyclohexane)	B2/C		(1)	5E−01
m-Phenylenediamine	D		2E−01	5E+02
Maleic anhydride	D		4E−00	8E+03
Maleic hydrazide	D		2E+01	4E+04
Mercury (inorganic)	D		(1)	2E+01
Methacrylonitrile	D	7E−01	4E−03	8E-00
Methomyl	D		9E−01	2E+03
Methyl chlorocarbonate	D			
Methyl ethyl ketone	D	3E+02	2E−00	4E+03
Methyl isobutyl ketone	D	7E+01	2E−00	4E+03
Methyl parathion	D		9E−03	2E+01

APPENDIX A.—EXAMPLES OF CONCENTRATIONS MEETING CRITERIA FOR ACTION LEVELS—Continued

[Section 264.521(a)(2)(i-iv)]

Constituent name	Class	Air (ug/m^3)	Water (mg/L)	Soils (mg/kg)
Methylene chloride	B	3E−01	5E−03	9E+01
n-Nitroso-di-n-butylamine	B2	6E−04	6E−06	1E−01
n-Nitroso-n-ethylurea	B			
n-Nitroso-n-methylethylamine	B2		2E−06	3E−02
n-Nitrosodi-n-propylamine	B2		5E−06	1E−01
n-Nitrosodiethanolamine	B2		1E−05	3E−01
n-Nitrosodiphenylamine	B2		7E−03	1E+[illegible]
n-Nitrosopyrrolidine	B2	2E−03	2E−05	[illegible]
Nickel	D		7E−01	[illegible]
Nickel refinery dust	A	4E−03		
Nitric oxide	D		4E−00	8E+03
Nitrobenzene	D	2E−00	2E−02	4E+01
Nitrogen dioxide	D		4E+01	8E+04
Osmium tetroxide	D		4E−04	8E−01
Parathion	C		2E−01	5E+02
Pentachlorobenzene	D		3E−02	6E+01
Pentachloronitrobenzene	C	1E−01	1E−01	2E+02
Pentachlorophenol	D		1E−00	2E+03
Phenol	D		2E+01	5E+04
Phenyl mercuric acetate	D		3E−03	6E−00
Phosphine	D		1E−02	2E+01
Phthalic anhydride	D		7E+01	2E+05
Polychlorinated biphenyls	B2		5E−08	9E−02
Potassium cyanide	D		2E−00	4E+03
Potassium silver cyanide	D		7E−00	2E+04
Pronamide	D		3E−00	6E+03
Pyridine	D		4E−02	8E+01
Selenious acid	D		1E−01	2E+02
Selenourea	D		2E−01	4E+02
Silver	D		(1)	2E+02
Silver cyanide	D		4E−00	8E+03
Sodium cyanide	D		1E−00	3E+03
Strychnine	D		1E−02	2E+01
Styrene	C		7E−00	2E+04
1,1,1,2-Tetrachloroethane	C	1E−00	1E−02	3E+02
1,2,4,5-Tetrachlorobenzene	D		1E−02	2E+01
1,1,1,2-Tetrachloroethane	C	1E−00	1E−02	3E+02
1,1,2,2-Tetrachloroethane	C	2E−01	2E−03	4E+01
Tetrachloroethylene	B2	1E−00	7E−04	1E+01
2,3,4,6-Tetrachlorophenol	D		1E−00	2E+03
Tetraethyl lead	D		4E−06	8E−03
Tetraethyldithiopyrophosphate	D		2E−02	4E+01
Thallic oxide	D		2E−03	6E−00
Thallium acetate	D		3E−03	7E−00
Thallium carbonate	D		3E−03	6E−00
Thallium chloride	D		3E−03	6E−00
Thallium nitrate	D		3E−03	7E−00
Thallium sulfate	D		3E−03	6E−00
Thiosemicarbazide	D		2E−01	5E+02
Thiram	D		2E−01	4E+02
Toluene	D	7E+03	1E+01	2E+04
Toxaphene	B2	3E−03	(1)	6E−01
1,2,4-Trichlorobenzene	D	1E+01	7E−01	2E+03
1,1,1-Trichloroethane	D	1E+03	3E−00	7E+03
1,1,2-Trichloroethane	C	6E−01	6E−03	1E+02
Trichloroethylene	B2		(1)	6E+01
Trichloromonofluoromethane	D	7E+02	1E+01	2E+04
2,4,5-Trichlorophenol	D		4E−00	8E+03
2,4,6-Trichlorophenol	B2	2E−01	2E−03	4E+01
2,4,5-Trichlorophenoxyacetic acid	D		(1)	8E+02
1,2,3-Trichloropropane	D		2E−01	5E+02
Vanadium pentoxide	D		3E−01	7E+02
Xylenes	D	1E+03	7E+01	2E+05
Zinc cyanide	D		2E−00	4E+03
Zinc phosphide	D		1E−02	2E+01

(1) MCL available; see appendix B.

(2) The air action level for asbestos is measured in units of fibers/milliliters.

(3) There is an MCL for total trihalomethanes, which includes four constituents: bromoform, bromodichloromethane, chloroform, and dibromochloromethane. Concentration derived using exposure assumptions in appendix D and reference doses for systemic toxicants and verified risk-specific doses at 10−6 for Class A and B carcinogens and 10−5 for Class C carcinogens (see section VI.F.2.6 for further discussion).

A, B and C represent class A, B and C carcinogens, respectively; D represents a systemic toxicant.

APPENDIX B—MAXIMUM CONTAMINANT LEVELS

Constituent	MCL (ppm)
Arsenic	0.05
Barium	1
Benzene	0.005
Cadmium	0.010
Carbon tetrachloride	0.005
Chromium VI	0.05
p-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007

APPENDIX B—MAXIMUM CONTAMINANT LEVELS—Continued

Constituent	MCL (ppm)
2,4-D	0.1
2,4,5-TP Silvex	0.01
Endrin	0.0002
Fluoride	4.0
Lead	0.05
Lindane	0.004
Mercury	0.002
Methoxychlor	0.1
Nitrate	10

APPENDIX B—MAXIMUM CONTAMINANT LEVELS—Continued

Constituent	MCL (ppm)
Selenium	0.01
Silver	0.05
Toxaphene	0.005
1,1,1-Trichloroethane	0.2
Trichloroethylene	0.005
Trihalomethanes, total [1]	0.10
Vinyl chloride	0.002

[1] Including chloroform, bromoform, bromodichloromethane, and dibromochloromethane

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	MaxWater (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Acetone	D						
Acetonitrile	D						
Acetophenone	D						
Acrylamide	B2	8E-02	8E-04	8E-04	8E-06	2E+01	2E-01
Acrylonitrile	B1	1E-00	1E-02	6E-03	6E-05	1E+02	1E-00
Aldicarb	D						
Aldrin	B2	2E-02	2E-04	2E-04	2E-06	4E-00	4E-02
Allyl alcohol	D						
Aluminum phosphide	D						
Aniline	B2			6E-01	6E-03	1E+04	1E+02
Antimony	D						
Arsenic	A	7E-03	7E-05				
Asbestos (2)	A	2E-00	2E-02				
Barium cyanide	D						
Barium, ionic	D						
Benzidine	A	2E-03	2E-05	2E-05	2E-07	3E-01	3E-03
Beryllium	B2	4E-02	4E-04	8E-04	8E-06	2E+01	2E-01
Bis(2-ethylhexyl)phthalate	B2			3E-01	3E-03	5E+03	5E+01
Bis(chloroethyl)ether	B2	3E-01	3E-03	3E-03	3E-06	6E+01	6E-01
Bromodichloromethane	B2			3E-03	3E-05	5E+01	5E-01
Bromoform	D						
Bromomethane	D						
Butyl benzyl phthalate	C						
Cadmium	B1	6E-02	6E-04				
Calcium cyanide	D						
Carbon disulfide	D						
Carbon tetrachloride	B2	3E-00	3E-02	3E-02	3E-04	5E+02	5E-00
Chloral	D						
Chlordane	B2	3E-01	3E-03	3E-03	3E-05	5E+01	5E-01
Chlorine cyanide	D						
Chlorobenzene	D						
Chloroform	B2	4E-00	4E-02	6E-01	6E-03	1E+04	1E+02
2-Chlorophenol	D						
Chromium (VI)	A	9E-03	9E-05				
Copper cyanide	D						
m-Cresol	D						
o-Cresol	D						
p-Cresol	D						
Cyanide	D						
Cyanogen	D						
Cyanogen bromide	D						
DDD	B2			1E-02	1E-04	3E+02	3E-00
DDE	B2			1E-02	1E-04	2E+02	2E-00
DDT	B2	1E-00	1E-02	1E-02	1E-04	2E+02	2E-00
Dibutyl phthalate	D						
Dibutylnitrosamine	B2	6E-02	6E-04	6E-04	6E-06	1E+01	1E-01
3,3'-Dichlorobenzidine	B2			8E-03	8E-05	2E+02	2E-00
Dichlorodifluoromethane	D						
1,2-Dichloroethane	B2	4E-00	4E-02	4E-02	4E-04	8E+02	8E-00
1,1-Dichloroethylene	C	3E-01	3E-03	6E-03	6E-05	1E+02	1E-00
2,4-Dichlorophenol	D						
2,4-Dichlorophenoxyacetic acid	D						
1,3-Dichloropropene	B2						
Dieldrin	B2	2E-02	2E-04	2E-04	2E-06	4E-00	4E-02
Diethyl phthalate	D						

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS—Continued

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	Max-Water (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Diethylnitrosamine	B2	2E-03	2E-05	2E-05	2E-07	5E-01	5E-03
Dimethoate	D						
Dimethylnitrosamine	B2	7E-03	7E-05	7E-05	7E-07	1E-00	1E-02
m-Dinitrobenzene	D						
2,4-Dinitrophenol	D						
2,3-Dinitrotoluene (and 2,6-, mixture)	B2			5E-03	5E-05	1E+02	1E-00
1,4-Dioxane	B2			3E-01	3E-03	6E+03	6E+01
Diphenylamine	D						
1,2-Diphenylhydrazine	B2	4E-01	4E-03	4E-03	4E-05	9E+01	9E-01
Disulfoton	D						
Endosulfan	D						
Endothall	D						
Endrin	D						
Epichlorohydrin	B2	8E+01	8E-01	4E-01	4E-03	7E+03	7E+01
Ethylbenzene	D						
Ethylene dibromide	B2	5E-01	5E-03	4E-05	4E-07	8E-01	8E-03
Formaldehyde	B1	8E-00	8E-02				
Formic acid	D						
Glycidyaldehyde	D						
Heptachlor	B2	8E-02	8E-04	8E-04	8E-06	2E+01	2E-01
Heptachlor epoxide	B2	4E-02	4E-04	4E-04	4E-06	8E-00	8E-02
Hexachlordibenzo-p-dioxin	B2	6E-05	6E-07	6E-07	1E-08	1E-02	1E-04
Hexachlorobutadiene	C	4E-00	4E-02	4E-02	4E-04	9E+02	9E-00
alpha-Hexachlorocyclohexane	B2	6E-02	6E-04	6E-04	6E+06	1E-01	1E-01
beta-Hexachlorocyclohexane	C	2E-01	2E-03	2E-03	2E-05	4E+01	4E-01
Hexachlorocyclopentadiene	D						
Hexachloroethane	C	3E+01	3E-01	3E-01	3E-03	5E+03	5E+01
Hexachlorophene	D						
Hydrazine	B2	2E-02	2E-04	1E-03	1E-06	2E+01	2E-01
Hydrogen cyanide	D						
Hydrogen sulfite	D						
Isobutyl alcohol	D						
Isophorone	C			9E-01	9E-03	2E+04	2E+02
Lead	B2						
Lindane (gamma-hexachlorocyclohexane)	B2/C			3E-03	3E-05	5E+01	5E-[illegible]
m-Phenylenediamine	D						
Maleic anhydride	D						
Maleic hydrazide	D						
Mercury (inorganic)	D						
Methacrylonitrile	D						
Methomyl	D						
Methyl chlorocarbonate	D						
Methyl ethyl ketone	D						
Methyl isobutyl ketone	D						
Methyl parathion	D						
Methylene chloride	B	3E+01	3E-01	5E-01	5E-03	9E+03	9E+01
n-Nitroso-di-n-butylamine	B2	6E-02	6E-04	6E-04	6E+06	1E-01	1E-01
n-Nitroso-n-ethylurea	B						
n-Nitroso-n-methylethylamine	B2			2E-04	2E-06	3E-00	3E-02
n-Nitrosodi-n-propylamine	B2			5E-04	5E-06	1E+01	1E-01
n-Nitrosodiethanolamine	B2			1E-03	1E-05	3E+01	3E-01
n-Nitrosodiphenylamine	B2			7E-01	7E-03	1E+04	1E+02
n-Nitrosopyrrolidine	B2	2E-01	2E-03	2E-03	2E-05	3E+01	3E-01
Nickel	D						
Nickel refinery dust	A	4E-01	4E-03				
Nitric oxide	D						
Nitrobenzene	D						
Nitrogen dioxide	D						
Osmium tetroxide	D						
Parathion	C						
Pentachlorobenzene	D						
Pentachloronitrobenzene	C	1E-00	1E-02				
Pentachlorophenol	D						
Phenol	D						
Phenyl mercuric acetate	D						
Phosphine	D						
Phthalic anhydride	D						
Polychlorinated biphenyls	B2			5E-04	5E-06	9E-00	9E-02
Potassium cyanide	D						
Potassium silver cyanide	D						
Pronamide	D						
Pyridine	D						
Selenious acid	D						
Selenourea	D						
Silver	D						
Silver cyanide	D						
Sodium cyanide	D						
Strychnine	D						

APPENDIX C—RANGE OF CONCENTRATIONS FOR ESTABLISHING MEDIA PROTECTION STANDARDS FOR CARCINOGENS—Continued

Constituent name	Class	MaxAir (ug/m 3)	MinAir (ug/m 3)	Max-Water (mg/L)	MinWater (mg/L)	MaxSoil (mg/kg)	MinSoil (mg/kg)
Styrene	C						
1,1,1,2-Tetrachlorethane	C	1E+01	1E-01	1E-01	3E+03	3E+03	3E+01
1,2,4,5-Tetrachlorobenzene	D						
1,1,1,2-Tetrachloroethane	C	1E+01	1E-01	1E-01	1E-03	3E+03	3E+01
1,1,2,2-Tetrachloroethane	C	2E-00	2E-02	2E-02	2E-04	4E+02	4E-00
Tetrachloroethylene	B2	1E+02	1E-00	7E-02	7E-04	1E+03	1E+01
2,3,4,6-Tetrachlorophenol	D						
Tetraethyl lead	D						
Tetraethyldithiopyrophosphate	D						
Thallic oxide	D						
Thallium acetate	D						
Thallium carbonate	D						
Thallium chloride	D						
Thallium nitrate	D						
Thallium sulfate	D						
Thiosemicarbazide	D						
Thiram	D						
Toluene	D						
Toxaphene	B2	3E-01	3E-03	3E-03	3E-05	6E+01	6E-01
1,2,4-Trichlorobenzene	D						
1,1,1,Trichloroethane	D						
1,1,2-Trichloroethane	C	6E-00	6E-02	6E-02	6E-04	1E+03	1E+01
Trichloroethylene	B2			3E-01	3E-03	6E+03	6E+01
Trichloromonofluoromethane	D						
2,4,5-Trichlorophenol	D						
2,4,6-Trichlorophenol	B2	2E+01	2E-01	2E-01	2E-03	4E+03	4E+01
2,4,5-Trichlorophenoxyacetic acid	D						
1,2,3-Trichloropropane	D						
Vanadium pentoxide	D						
Xylenes	D						
Zinc cyanide	D						
Zinc phosphide	D						

Appendix D: Recommended Exposure Assumptions for Use in Deriving Action Levels

(Sections 264.521 (a)(2); (b); (c)(3); and (d))

1. In deriving action levels for hazardous constituents in ground-water, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period.

2. In deriving action levels for hazardous constituents in air, assume air intake of 20 cubic meters/day for 70 kg adult/70 year lifetime exposure period.

3. In deriving action levels for hazardous constituents in soil, which are known or suspected to be carcinogens, assume soil intake of 0.1 gram/day for 70 kg adult/70 year lifetime exposure period.

4. In deriving action levels for hazardous constituents in soil, other than those which are known or suspected to be carcinogens, assume soil intake of 0.2 gram/day for 16 kg child/5 year exposure period (age 1–6).*

5. In deriving action levels for hazardous constituents in surface water designated by the State for use as a drinking water source, assume a water intake of 2 liters/day for 70 kg adult/70 year lifetime exposure period, unless intake of aquatic organisms is also of concern.

*Not to be averaged over a 70-year lifetime.

Appendix E: Examples of Calculations of Action Levels

I. Governing Equations for Calculating Action Levels

A. *Systemic Toxicants*

$C_m = [RfD*W]/[I*A]$

where:

C_m = action level in medium (units are medium-dependent);

RfD = reference dose (mg/kg/day);

W = body weight (kg);

I = intake assumption (units are medium-dependent); and

A = absorption factor [1] (dimensionless).

B. *Carcinogenic Constituents*

$C_m = [R*W*LT]/[CSF*I*A*ED]$

where:

C_m = action level in medium (units are medium-dependent);

R = assumed risk level (dimensionless) (10^{-6} for class A & B; 10^{-5} for class C carcinogens);

W = body weight (kg);

LT = assumed lifetime (years);

CSF = carcinogenic slope factor (mg/kg/day)$^{-1}$;

I = intake assumption (units are medium-dependent);

A = absorption factor (dimensionless); and

ED = exposure duration (years).

[1] Assumed to be 1 for this appendix, based upon the assumption that the human absorption rate will be the same as the rate in the study upon which the RfD or CPF was developed.

II. Example Calculations for Hazardous Constituents in Air

A. *Systemic Toxicants*

Example calculation for 2,4-dinitrophenol:

C_a = [0.002 (mg/kg/d)*1000 (μg/mg)*70(kg)]/[20 (m³/d)*1] = 7.0 μg/m³

where:

C_a = action level in air (μg/m³)

RfD = 0.002 mg/kg/day

W = 70 kg adult

I = 20 m³/day

A = 1

B. *Carcinogenic Constituents*

Example calculation for 1,1,2,2-tetrachloroethane:

C_a = [10^{-6}*1000 (μg/mg)*70 yrs)*70 (kg)]/[0.20 (mg/kg/day)$^{-1}$*20 (m³/day)*1*70 (yrs)] = .175 μg/m

where:

C_a = action level in air (μg/m³)

R = 10^{-6} (1,1,2,2-Tetrachloroethane is a Class C carcinogen)

W = 70 kg adult

LT = 70 year lifetime

CSF = 0.20 (mg/kg/day)$^{-1}$

I = 20 m³/day

A = 1

ED = 70 year exposure duration

III. Sample Calculation for Hazardous Constituents in Water

A. *Systemic Toxicants*

Sample calculation for toluene:

C_w = [0.30 (mg/kg/day)*70 (kg)]/[2 (L/day)*1] = 10.5 mg/L

where:

C_w = action level in water (mg/L)

RfD = 0.30 mg/kg/day for toluene
W = 70 kg adult
I = 2 L/day
A = 1

B. *Carcinogenic Constituents*

Sample calculation for 1,1,2,2-tetrachloroethane:

$C_w = [10^{-6} \cdot 70\ (kg) \cdot 70\ (yr)] / [0.20\ (mg/kg/day)^{-1} \cdot 2\ (L/day) \cdot 1 \cdot 70\ (yr)] = 1.75E{-}03$ mg/L

where:
C_w = action level in water (mg/L)
R = 10^{-6} (1,1,2,2-Tetrachloroethane is a Class C carcinogen)
W = 70 kg adult
LT = 70 year lifetime
CSF = 0.20 $(mg/kg/day)^{-1}$
I = 2 L/day
A = 1
ED = 70 year exposure duration

IV. Sample Calculations for Hazardous Constituents in Soils

A. *Systemic Toxicants*

Example calculations for toluene:

$C_s = [0.30\ (mg/kg/day) \cdot 16\ (kg)] / [0.2\ (g/day) \cdot 1 \cdot 0.001\ (kg/g)] = 24{,}000$ mg/kg

where:
C_s = action level in soil (mg/kg)
RfD = 0.30 mg/kg/day for toluene
W = 16 kg (5 year old child)
I = 0.2 g/day
A = 1

B. *Carcinogenic Constituents*

Sample calculation for 1,1,2,2-tetrachloroethane:

$C_s = [10^{-6} \cdot 70\ (kg) \cdot 70\ (yrs)] / [0.20\ (mg/kg/day)^{-1} \cdot 0.1\ (g/day) \cdot 0.001\ (kg/g) \cdot 1 \cdot 70\ (yrs)] = 35.0$ mg/kg

where:
C_s = action level in soil (mg/kg)
R = 10^{-6} (1,1,2,2-tetrachloroethane is a Class C carcinogen)
W = 70 kg adult
LT = 70 year lifetime
CSF = 0.20 $(mg/kg/day)^{-1}$
I = 0.1 g/day
A = 1
ED = 70 year exposure duration

APPENDIX F—LIST OF CONSTITUENTS SHOWING ACTION LEVEL SOURCE DATA

Constituent name	Class	Noncarcinogenic effects		Carcinogenic effects	
		Oral RFD (mg/kg/d)	Inhalation RFD (mg/kg/d)	Oral slope factor (mg/kg/d)-1	Inhalation slope factor (mg/kg/d)-1
Acetone	D	1.0E−01			
Acetonitrile	D	6.0E−03			
Acetophenone	D	1.0E−01	5.0E−05		
Acrylamide	B2	2.0E−04		4.5E−00	4.5E−00
Acrylonitrile	B1			5.4E−01	2.4E−01
Aldicarb	D	1.3E−03			
Aldrin	B2	3.0E−05		1.7E+01	1.7E+01
Allyl alcohol	D	5.0E−03			
Aluminum phosphide	D	4.0E−04			
Aniline	B2			5.7E−03	
Antimony	D	4.0E−04			
Arsenic	A	1.0E−03			5.0E+01
Asbestos (2)	A				2.3E−0
Barium cyanide	D	7.0E−02			
Barium, ionic	D	5.0E−02	1.0E−04		
Benzidine	A	3.0E−03		2.3E+02	2.3E+02
Beryllium	B2	5.0E−03		4.3E−00	8.4E−00
Bis(2-ethylhexyl)phthalate	B2	2.0E−02		1.4E−02	
Bis(chloroethyl)ether	B2			1.1E−00	1.1E−00
Bromodichloromethane	B2	2.0E−02		1.3E−00	
Bromoform	D	2.0E−02			
Bromomethane	D	1.4E−03	8.0E−03		
Butyl benzyl phthalate	C	2.0E−01			
Cadmium	B1	5.0E−04			6.1E−00
Calcium cyanide	D	4.0E−02			
Carbon disulfide	D	1.0E−01			
Carbon tetrachloride	B2	7.0E−04		1.3E−01	1.3E−01
Chloral	D	2.0E−03			
Chlordane	B2	6.0E−05		1.3E−00	1.3E−00
Chlorine cyanide	D	5.0E−02			
Chlorobenzene	D	2.0E−02	5.0E−03		
Chloroform	B2	1.0E−02		6.1E−03	8.1E−02
2-Chlorophenol	D	5.0E−03			
Chromium (VI)	A	5.0E−03			4.1E+01
Copper cyanide	D	5.0E−03			
m-Cresol	D	5.0E−02			
o-Cresol	D	5.0E−02			
p-Cresol	D	5.0E−02			
Cyanide	D	2.0E−02			
Cyanogen	D	4.0E−02			
Cyanogen bromide	D	9.0E−02			
DDD	B2			2.4E−01	
DDE	B2			3.4E−01	
DDT	B2	5.0E−04		3.4E−01	3.4E−01
Dibutyl phthalate	D	1.0E−01			
Dibutylnitrosamine	B2			5.4E−00	5.4E−00
3,3'-Dichlorobenzidine	B2			4.5E−01	
Dichlorodifluoromethane	D	2.0E−01	5.0E−02		
1,2-Dichloroethane	B2			9.1E−02	9.1E−02
1,1-Dichloroethylene	C	9.0E−03		6.0E−01	1.2E−00
2,4-Dichlorophenol	D	3.0E−03			
2,4-Dichlorophenoxyacetic acid	D	1.0E−02			
1,3-Dichloropropene	B2	3.0E−04			
Dieldrin	B2	5.0E−05		1.6E+01	1.6E+01
Diethyl phthalate	D	8.0E−01			
Diethylnitrosamine	B2			1.5E+02	1.5E+02

APPENDIX F—LIST OF CONSTITUENTS SHOWING ACTION LEVEL SOURCE DATA—Continued

Constituent name	Class	Noncarcinogenic effects		Carcinogenic effects	
		Oral RFD (mg/kg/d)	Inhalation RFD (mg/kg/d)	Oral slope factor (mg/kg/d)-1	Inhalation slope factor (mg/kg/d) 1
Dimethoate	D	2.0E−02			
Dimethylnitrosamine	B2			5.1E+01	5.1E+01
m-Dinitrobenzene	D	1.0E−04			
2,4-Dinitrophenol	D	2.0E−03			
2,3-Dinitrotoluene (and 2,6-, mixture)	B2			6.8E−01	
1,4-Dioxane	B2			1.1E−02	
Diphenylamine	D	2.5E−02			
1,2-Diphenylhydrazine	B2			8.0E−01	8.0E−01
Disulfoton	D	4.0E−05			
Endosulfan	D	5.0E−05			
Endothall	D	2.0E−02			
Endrin	D	3.0E−04			
Epichlorohydrin	B2	2.0E−03		9.9E−03	4.2E−03
Ethylbenzene	D	1.0E−01			
Ethylene dibromide	B2			8.5E+01	7.6E−01
Formaldehyde	B1				4.5E−02
Formic acid	D	2.0E−00			
Glycidylaldehyde	D	4.0E−04			
Heptachlor	B2	5.0E−04		4.5E−00	4.5E−00
Heptachlor epoxide	B2	1.3E−05		9.1E−00	9.1E−00
Hexachlorodibenzo-p-dioxin	B2			6.2E+03	6.2E+03
Hexachlorobutadiene	C	2.0E−03		7.8E−02	7.8E−02
alpha-Hexachlorocyclohexane	B2			6.3E−00	6.3E−00
beta-Hexachlorocyclohexane	C			1.8E−00	1.8E−00
Hexachlorocyclopentadiene	D	7.0E−03	2.0E−05		
Hexachloroethane	C	1.0E−03		1.4E−02	1.4E−02
Hexachlorophene	D	3.0E−04			
Hydrazine	B2			3.0E−00	1.7E+01
Hydrogen cyanide	D	2.0E−02			
Hydrogen sulfide	D	3.0E−03			
Isobutyl alcohol	D	3.0E−01			
Isophorone	C	2.0E−01		4.1E−03	
Lead	B2				
Lindane (gamma-hexachlorocyclohexane)	B2/C	3.0E−04		1.3E−00	
m-Phenylenediamine	D	6.0E−03			
Maleic anhydride	D	1.0E−01			
Maleic hydrazide	D	5.0E−01			
Mercury (inorganic)	D	3.0E−04			
Methacrylonitrile	D	1.0E−04	2.0E−04		
Methomyl	D	2.5E−02			
Methyl chlorocarbonate	D				
Methyl ethyl ketone	D	5.0E−02	9.0E−02		
Methyl isobutyl ketone	D	5.0E−02	2.0E−02		
Methyl parathion	D	2.5E−04			
Methylene chloride	B	6.0E−02		7.5E−03	1.4E−02
n-Nitroso-di-n-butylamine	B2			5.4E−00	5.4E−00
n-Nitroso-n-ethylurea	B				
n-Nitroso-n-methylethylamine	B2			2.2E+01	
n-Nitrosodi-n-propylamine	B2			7.0E−00	
n-Nitrosodiethanolamine	B2			2.8E−00	
n-Nitrosodiphenylamine	B2			4.9E−03	
n-Nitrosopyrrolidine	B2			2.1E−00	2.1E−00
Nickel	D	2.0E−02			
Nickel refinery dust	A				8.4E−01
Nitric oxide	D	1.0E−01			
Nitrobenzene	D	5.0E−04	6.0E−04		
Nitrogen dioxide	D	1.0E−00			
Osmium tetroxide	D	1.0E−05			
Parathion	C	6.0E−03			
Pentachlorobenzene	D	8.0E−04			
Pentachloronitrobenzene	C	3.0E−03			2.5E−01
Pentachlorophenol	D	3.0E−02			
Phenol	D	6.0E−01			
Phenyl mercuric acetate	D	8.0E−05			
Phosphine	D	3.0E−04			
Phthalic anhydride	D	2.0E−00			
Polychlorinated biphenyls	B2			7.7E−00	
Potassium cyanide	D	5.0E−02			
Potassium silver cyanide	D	2.0E−01			
Pronamide	D	7.5E−02			
Pyridine	D	1.0E−03			
Selenious acid	D	3.0E−03			
Selenourea	D	5.0E−03			
Silver	D	3.0E−03			
Silver cyanide	D	1.0E−01			
Sodium cyanide	D	4.0E−02			

APPENDIX F—LIST OF CONSTITUENTS SHOWING ACTION LEVEL SOURCE DATA—Continued

Constituent name	Class	Noncarcinogenic effects		Carcinogenic effect	
		Oral RFD (mg/kg/d)	Inhalation RFD (mg/kg/d)	Oral slope factor (mg/kg/d)-1	Inhalation slope factor (mg/kg/d) [1]
Strychnine	D	3.0E−04			
Styrene	C	2.0E−01			
1,1,1,2-Tetrachlorethane	C	3.0E−02		2.6E−02	2.6E−02
1,2,4,5-Tetrachlorobenzene	D	3.0E−04			
1,1,1,2-Tetrachloroethane	C	3.0E−02		2.6E−02	2.6E−02
1,1,2,2-Tetrachloroethane	C			2.0E−01	2.0E−01
Tetrachloroethylene	B2	1.0E−02		5.1E−02	3.3E−03
2,3,4,6-Tetrachlorophenol	D	3.0E−02			
Tetraethyl lead	D	1.0E−07			
Tetraethyldithiopyrophosphate	D	5.0E−04			
Thallic oxide	D	7.0E−05			
Thallium acetate	D	9.0E−05			
Thallium carbonate	D	8.0E−05			
Thallium chloride	D	8.0E−05			
Thallium nitrate	D	9.0E−05			
Thallium sulfate	D	8.0E−05			
Thiosemicarbazide	D	8.0E−03			
Thiram	D	5.0E−03			
Toluene	D	3.0E−01	2.0E−00		
Toxaphene	B2			1.1E−00	1.1E−00
1,2,4-Trichlorobenzene	D	2.0E−02	3.0E−03		
1,1,1-Trichloroethane	D	9.0E−02	3.0E−01		
1,1,2-Trichloroethane	C	4.0E−03		5.7E−02	5.7E−02
Trichloroethylene	B2			1.1E−02	
Trichloromonofluoromethane	D	3.0E−01	2.0E−01		
2,4,5-Trichlorophenol	D	1.0E−01			
2,4,6-Trichlorophenol	B2			2.0E−02	2.0E−02
2,4,5-Trichlorophenoxyacetic acid	D	1.0E−02			
1,2,3-Trichloropropane	D	6.0E−03			
Vanadium pentoxide	D	9.0E−03			
Xylenes	D	2.0E−00	3.0E−01		
Zinc cyanide	D	5.0E−02			
Zinc phosphide	D	3.0E−04			

For the reasons set out in the preamble, 40 CFR parts 264, 265, 270, and 271 are proposed to be amended as follows:

PART 264—STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

1. The authority citation for part 264 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6924, and 6925.

2. Section 264.1 is amended by revising paragraphs (d) and (g) introductory text to read as follows:

§ 264.1 Purpose, scope and applicability.

* * * * *

(d) The requirements of this part apply to a person disposing of hazardous waste by means of underground injection subject to a permit issued under an Underground Injection control (UIC) program approved or promulgated under the Safe Drinking Water Act only to the extent they are required by § 144.14 of this chapter and to the extent they are included in a RCRA permit by rule granted to such a person under part 270 of this chapter.

* * * * *

(g) Except as required under subpart S of this part governing releases from solid waste management units, the requirements of this part do not apply to:

* * * * *

§ 264.101 [Removed]

3. In 40 CFR part 264, subpart F, it is proposed to remove § 264.101.

4. In 40 CFR part 264, subpart G, it is proposed to amend § 264.113 by redesignating paragraphs (a)(1)(ii) as (a)(1)(iii) and (b)(1)(ii) as (b)(1)(iii), and by adding new paragraphs (a)(1)(ii) and (b)(1)(ii) to read as follows:

§ 264.113 Closure time allowed for closure.

* * * * *

(a) * * *

(1) * * *

(ii) Corrective action required at the unit or the facility under subpart S will delay the completion of partial or final closure; or

* * * * *

(b) * * *

(1) * * *

(ii) Corrective action required at the unit or the facility under subpart S will delay the completion of partial or final closure; or

* * * * *

5. 40 CFR part 264 is amended by adding subpart S to read as follows:

Subpart S—Corrective Action for Solid Waste Management Units

264.500 Purpose and applicability.
264.501 Definitions.
264.502–264.509 [Reserved].
264.510 Requirement to perform remedial investigations.
264.511 Scope of remedial investigations.
264.512 Plans for remedial investigations.
264.513 Reports of remedial investigations.
264.514 Determination of no further action.
264.515–264.519 [Reserved]
264.520 Requirement to perform corrective measure study.
264.521 Action levels.
264.522 Scope of corrective measure studies.
264.523 Plans for corrective measure studies.
264.524 Reports of corrective measure studies.
264.525 Selection of remedy
264.526 Permit modification for remedy.
264.527 Remedy design.
264.528 Progress reports.
264.529 Review of remedy implementation.
264.530 Completion of remedies.

APPENDIX D

DRMO STORAGE SHED - ANALYTICAL DATA

(Source: Reference 5,7)

TABLE 9

EVALUATION OF SOIL CONTAMINATION

DEFENSE REUTILIZATION & MARKETING OFFICE STORAGE

mg/kg
(ppm)

	pH	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	NICKEL	SELENIUM	SILVER
THRESHOLD	6.5 4.3	51.29	2.00	1.25	26.51	146.92	1.00	10.11	0.20	1.00
SAMPLE										
A-1	8.6 x	152.00 x	0.30	5.06 x	11.90	272.00 x	0.020	32.00 x	0.20	2.86 x
A-2	9.1 x	27.30	0.30	1.56 x	3.41	31.20	0.020	6.83	0.20	0.50
A-3	9.2 x	61.70 x	0.30	4.42 x	6.31	209.00 x	0.029	12.10 x	0.20	0.50
A-4	10.1 x	54.40 x	0.30	3.16 x	8.26	331.00 x	0.214	24.30 x	0.20	0.97
A-5	9.3 x	21.00	0.30	1.91 x	3.81	34.30	0.197	7.15	0.20	0.50
A-6	8.1 x	34.60	0.30	5.09 x	7.68	343.00 x	0.235	15.80 x	0.20	0.50
A-7	8.5 x	67.30 x	0.30	2.10 x	9.54	242.00 x	0.256	13.40 x	0.20	0.50
A-8	8.5 x	20.40	0.30	1.00	4.27	34.70	0.211	5.22	0.20	0.50
A-9	8.5 x	28.80	0.30	1.07	5.85	122.00	0.079	6.34	0.20	3.38 x
B-1	9.2 x	133.00 x	0.30	6.04 x	10.60	113.00	0.181	38.60 x	0.20	2.88 x
B-2	8.7 x	153.00 x	0.30	5.76 x	11.50	405.00 x	0.202	38.40 x	0.20	0.99
B-3	9.1 x	202.00 x	0.30	6.42 x	30.30 x	1114.00 x	0.204	35.80 x	0.20	0.50
B-4	8.6 x	51.40 x	0.30	4.51 x	15.40	739.00 x	0.219	23.50 x	0.20	1.00
B-5	8.5 x	64.30 x	0.30	6.58 x	28.40 x	1515.00 x	0.216	48.30 x	0.20	1.00
B-6	8.5 x	78.80 x	0.30	5.80 x	81.30 x	1041.00 x	0.187	68.40 x	0.20	0.50
B-7	8.4 x	49.60	0.30	1.57 x	10.80	191.00 x	0.187	8.84	0.20	0.98
B-8	8.6 x	64.30 x	0.30	2.16 x	10.30	208.00 x	0.196	12.30 x	0.20	0.50
B-9	8.4 x	12.30	0.30	0.54	4.94	35.50	0.228	7.40	0.20	0.50
C-3	8.6 x	34.00	0.30	1.31 x	5.82	172.00 x	0.189	11.20 x	0.20	0.95
C-4	8.4 x	46.60	0.30	2.23 x	12.40	384.00 x	0.112	10.00	0.20	0.50
C-5	9.0 x	57.20 x	0.30	2.70 x	34.90 x	371.00 x	0.106	19.50 x	0.20	1.00
C-6	9.1 x	56.30 x	0.30	2.64 x	15.90	647.00 x	0.081	15.90 x	0.20	0.50
C-7	10.2	48.40	0.30	2.56 x	10.10	254.00 x	0.070	17.80 x	0.20	0.50
C-8	8.0 x	41.90	0.30	3.35 x	20.90	460.00 x	0.188	22.50 x	0.20	2.34 x
C-9	8.4 x	129.00 x	0.30	5.40 x	12.20	275.00 x	0.084	41.30 x	0.20	2.44 x
C-1	8.9 x	98.50 x	0.44	5.12 x	15.60	349.00 x	0.044	38.00 x	0.20	2.48 x
C-2	8.7 x	108.00 x	0.30	4.67 x	12.90	601.00 x	0.045	38.20 x	0.20	0.50

TABLE 9 (CONTINUED)

mg/kg
(ppm)

	pH	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	NICKEL	SELENIUM	SILVER
THRESHOLD	6.5 4.3	51.29	2.00	1.25	26.51	146.92	1.00	10.11	0.20	1.00
SAMPLE										
D-1	8.8 X	130.00 X	0.30	5.48 X	22.70	410.00 X	0.104	43.40 X	0.20	1.97 X
D-2	9.0 X	182.00 X	0.30	4.87 X	13.40	486.00 X	0.059	34.80 X	0.20	2.48 X
D-3	8.4 X	54.80 X	0.30	3.24 X	19.90	643.00 X	0.213	26.40 X	0.20	0.50
D-4	8.2 X	61.60 X	0.30	3.67 X	26.30	3460.00 X	7.620 X	29.30 X	0.20	0.50
D-5	9.3 X	32.30	0.30	1.64 X	10.40	61.10	0.133	8.44	0.20	0.50
D-6	9.0 X	33.80	0.30	2.53 X	5.96	172.00 X	0.103	68.00 X	0.20	0.99
D-7	8.7 X	21.50	0.30	1.05	4.99	26.40	0.057	5.99	0.20	0.50
D-8	8.6 X	17.90	0.30	0.99	4.97	9.45	0.046	5.47	0.20	0.50
D-9	8.8 X	71.70 X	0.30	4.73 X	8.96	149.00 X	0.054	27.40 X	0.20	1.49 X
E-1	8.2 X	130.00 X	0.53	4.85 X	16.50	482.00 X	0.280	2270.00 X	0.20	4.37 X
E-2	8.3 X	121.00 X	0.30	3.95 X	10.10	271.00 X	0.121	20.70 X	0.20	1.44 X
E-3	9.0 X	43.60	0.30	2.11 X	10.30	333.00 X	0.227	12.70 X	0.20	0.98
E-4	8.5 X	38.40	0.30	1.90 X	5.69	345.00 X	0.531	7.11	0.20	0.95
E-5	8.6 X	39.00	0.30	2.25 X	4.50	75.50	0.547	8.00	0.20	0.50
E-6	9.6 X	27.40	0.30	1.78 X	4.81	156.00 X	0.101	6.26	0.20	0.50
E-7	8.6 X	18.70	0.30	1.68 X	11.80	256.00 X	0.065	13.30 X	0.20	0.50
E-8	7.9 X	50.30	0.30	3.34 X	436.00 X	1421.00 X	0.193	25.40 X	0.20	1.00
E-9	8.6 X	178.00 X	0.30	4.90 X	9.72	96.20	0.058	32.80 X	0.20	2.31 X
ST-1	8.8 X	4880.00 X	0.30	4.23 X	38.90 X	1879.00 X	0.163	46.20 X	0.20	0.50
ST-2	8.6 X	39.80	0.30	3.01 X	20.90	680.00 X	0.067	22.80 X	0.20	0.97
ST-3	7.7 X	79.80 X	0.30	3.88 X	89.80 X	2612.00 X	0.035	29.60 X	0.20	0.91
ST-4	8.1 X	79.40 X	0.30	4.34 X	26.00	864.00 X	0.095	32.40 X	0.20	1.00
ST-5	8.7 X	40.00	0.30	4.23 X	15.90	914.00 X	0.093	23.60 X	0.20	0.91
ST-6	8.1 X	74.4 X	0.30	6.52 X	99.9 X	4362 X	0.257	34.7 X	0.20	0.91
ST-7	8.7 X	35.4	0.30	2.08 X	10.7	200 X	0.054	13.6 X	0.20	0.5
ST-8	8.3 X	43.6	0.30	2.34 X	9.84	283 X	0.106	17.8 X	0.20	0.94

SOUTHERN DIVISION NAVAL FACILITIES
DELIVERY ORDER # 0097
DRMO STORAGE SHED SOIL SAMPLES
CHARLESTON, SC NAVAL SHIPYARD

ETC #	Sample I.D.	Date	Results (as received ppm)							
			pH	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Silver
170	A-1-1	3/28	8.1	14.1	<0.1	-	8.78	-	3.05	<0.5
171	A-1-2	3/28	8.1	92.8	<0.1	-	10.3	-	21.0	1.29
172	A-1-3	3/28	7.8	22.8	<0.1	-	9.40	-	1.79	<0.5
173	A-2-1	3/28	7.9	-	<0.1	-	-	-	-	-
174	A-2-2	3/28	8.3	-	<0.1	-	-	-	-	-
175	A-2-3	3/28	8.1	-	<0.1	-	-	-	-	-
176	A-3-1	3/28	5.5	1.75	<0.1	-	12.3	-	<1.0	-
177	A-3-2	3/28	7.5	15.4	<0.1	-	12.6	-	<1.0	-
178	A-3-3	3/28	8.1	36.2	<0.1	-	17.9	-	20.9	-
179	A-4-1	3/28	6.4	3.07	<0.1	-	11.0	-	<1.0	-
180	A-4-2	3/28	8.2	25.0	2.36	-	24.5	-	5.35	-
181	A-4-3	3/28	7.8	10.6	<0.1	-	17.4	-	3.67	-
182	A-5-1	3/28	4.3	-	<0.1	-	-	-	-	-
183	A-5-2	3/28	8.2	-	<0.1	-	-	-	-	-
184	A-5-3	3/28	7.8	-	1.86	-	-	-	-	-
185	A-6-1	3/28	4.8	-	<0.1	-	<2.5	-	<1.0	-
186	A-6-2	3/28	8.1	-	<0.1	-	8.67	-	2.89	-
187	A-6-3	3/28	8.0	-	<0.1	-	13.3	-	12.3	-
188	A-7-1	3/28	5.1	10.0	<0.1	-	6.97	-	<1.0	-
189	A-7-2	3/28	8.1	10.9	<0.1	-	8.18	-	2.34	-
190	A-7-3	3/28	7.9	60.0	<0.1	-	13.7	-	17.0	-
191	A-8-1	3/28	4.9	-	-	-	-	-	-	-
192	A-8-2	3/28	8.4	-	-	-	-	-	-	-
193	A-8-3	3/28	8.4	-	-	-	-	-	-	-
194	A-9-1	3/28	5.9	-	-	-	-	-	-	<0.5
195	A-9-2	3/28	8.3	-	-	-	-	-	-	<0.5
196	A-9-3	3/28	8.0	-	-	-	-	-	-	<0.5
197	B-1-1	3/28	8.3	12.0	<0.1	-	-	-	3.98	<0.5
198	B-1-2	3/28	8.3	7.93	<0.1	-	-	-	<1.0	<0.5
199	B-1-3	3/28	8.2	16.9	<0.1	-	-	-	7.19	<0.5
200	B-2-1	3/28	7.4	<1.5	<0.1	-	7.45	-	<1.0	-
201	B-2-2	3/28	8.2	16.5	<0.1	-	10.8	-	7.06	-
202	B-2-3	3/28	8.3	68.0	<0.1	-	17.5	-	16.1	-
203	B-3-1	3/28	7.1	<1.5	<0.1	6.03	<2.5	-	<1.0	-
204	B-3-2	3/28	7.4	6.38	<0.1	16.9	15.5	-	<1.0	-
205	B-3-3	3/28	7.2	68.0	<0.1	35.8	14.5	-	20.4	-
206	B-4-1	3/28	5.2	<1.5	<0.1	-	9.60	-	<1.0	-
207	B-4-2	3/28	8.0	21.1	<0.1	-	11.8	-	9.31	-
208	B-4-3	3/28	8.1	52.2	<0.1	-	17.0	-	16.5	-
209	B-5-1	3/28	5.4	4.36	<0.1	2.54	4.72	-	<1.0	-
210	B-5-2	3/28	7.9	11.7	<0.1	15.0	11.2	-	7.01	-
211	B-5-3	3/28	8.3	55.5	<0.1	25.0	15.5	-	15.5	-

SOUTHERN DIVISION NAVAL FACILITIES

DELIVERY ORDER # 0097

DRMO STORAGE SHED SOIL SAMPLES

CHARLESTON, SC NAVAL SHIPYARD

ETC #	Sample I.D.	Date	Results (as received ppm) pH	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Silver
300	E-8-2	3/29	8.0	-	<0.1	32.7	10.6	-	18.9	-
301	E-8-3	3/29	7.6	-	<0.1	14.3	15.2	-	10.1	-
302	E-9-1	3/29	7.5	5.99	<0.1	-	-	-	<1.0	<0.5
303	E-9-2	3/29	7.7	30.6	<0.1	-	-	-	11.6	<0.5
304	E-9-3	3/29	7.3	10.2	<0.1	-	-	-	<1.0	<0.5
305	ST-1-1	3/30	4.5	<1.5	<0.1	2.46	<2.5	-	<1.0	-
306	ST-1-2	3/30	7.8	9.99	<0.1	4.76	<2.5	-	<1.0	-
307	ST-1-3	3/30	7.9	35.6	<0.1	35.6	14.4	-	24.4	-
308	ST-2-1	3/30	6.8	-	<0.1	-	<2.5	-	<1.0	-
309	ST-2-2	3/30	8.0	-	<0.1	-	<2.5	-	<1.0	-
310	ST-2-3	3/30	8.0	-	<0.1	-	13.2	-	11.7	-
311	ST-3-1	3/30	4.7	7.97	<0.1	1.49	<2.5	-	<1.0	-
312	ST-3-2	3/30	8.5	<1.5	<0.1	6.98	7.48	-	<1.0	-
313	ST-3-3	3/30	8.3	35.0	<0.1	17.5	9.99	-	6.99	-
314	ST-4-1	3/30	7.5	9.04	<0.1	-	34.3	-	1.90	-
315	ST-4-2	3/30	7.5	7.98	<0.1	-	19.5	-	3.99	-
316	ST-4-3	3/30	7.8	14.4	<0.1	-	60.0	-	4.46	-
317	ST-5-1	3/30	4.9	-	<0.1	-	5.97	-	<1.0	-
318	ST-5-2	3/30	8.5	-	<0.1	-	12.5	-	<1.0	-
319	ST-5-3	3/30	8.2	-	<0.1	-	14.0	-	19.0	-
320	ST-6-1	3/30	7.3	<1.5	<0.1	3.50	<2.5	-	<1.0	-
321	ST-6-2	3/30	8.3	13.6	<0.1	11.2	<2.5	-	1.46	-
322	ST-6-3	3/30	8.4	10.5	<0.1	6.50	<2.5	-	<1.0	-
323	ST-7-1	3/30	5.2	-	<0.1	-	<2.5	-	<1.0	-
324	ST-7-2	3/30	8.1	-	<0.1	-	9.24	-	8.26	-
325	ST-7-3	3/30	8.1	-	<0.1	-	11.9	-	11.4	-
326	ST-8-1	3/30	5.5	-	<0.1	-	<2.5	-	<1.0	-
327	ST-8-2	3/30	8.2	-	<0.1	-	6.46	-	<1.0	-
328	ST-8-3	3/30	7.9	-	<0.1	-	12.8	-	14.3	-

SOUTHERN DIVISION NAVAL FACILITIES

DELIVERY ORDER # 0097

DRMO STORAGE SHED SOIL SAMPLES

CHARLESTON, SC NAVAL SHIPYARD

ETC #	Sample I.D.	Date	Results (as received ppm) pH	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Silver
255	D-2-2	3/29	8.5	9.81	<0.1	-	10.8	-	3.43	<0.5
256	D-2-3	3/29	8.3	43.9	<0.1	-	18.5	-	23.4	<0.5
257	D-3-1	3/29	8.2	11.6	<0.1	-	11.6	-	3.38	-
258	D-3-2	3/29	8.2	10.3	<0.1	-	11.8	-	15.2	-
259	D-3-3	3/29	8.3	35.2	<0.1	-	17.3	-	14.9	-
260	D-4-1	3/29	5.7	<1.5	<0.1	-	14.9	<0.02	<1.0	-
261	D-4-2	3/29	8.3	<1.5	<0.1	-	7.81	<0.02	<1.0	-
262	D-4-3	3/29	8.3	36.6	<0.1	-	13.1	<0.02	18.3	-
263	D-5-1	3/29	5.8	-	<0.1	-	-	-	-	-
264	D-5-2	3/29	8.3	-	<0.1	-	-	-	-	-
265	D-5-3	3/29	8.1	-	<0.1	-	-	-	-	-
266	D-6-1	3/29	8.0	-	<0.1	-	<2.5	-	<1.0	-
267	D-6-2	3/29	8.3	-	<0.1	-	<2.5	-	<1.0	-
268	D-6-3	3/29	8.1	-	<0.1	-	12.9	-	11.3	-
269	D-7-1	3/29	6.6	-	-	-	-	-	-	-
270	D-7-2	3/29	8.0	-	-	-	-	-	-	-
271	D-7-3	3/29	8.2	-	-	-	-	-	-	-
272	D-8-1	3/29	7.0	-	-	-	-	-	-	-
273	D-8-2	3/29	8.3	-	-	-	-	-	-	-
274	D-8-3	3/29	8.2	-	-	-	-	-	-	-
275	D-9-1	3/29	7.8	10.2	<0.1	-	12.1	-	3.88	<0.5
276	D-9-2	3/29	8.2	27.8	<0.1	-	60.4	-	15.1	<0.5
277	D-9-3	3/29	8.2	17.2	<0.1	-	15.8	-	3.82	<0.5
278	E-1-1	3/29	8.5	19.8	<0.1	-	20.3	-	6.45	<0.5
279	E-1-2	3/29	8.4	22.9	<0.1	-	11.9	-	14.8	<0.5
280	E-1-3	3/29	8.6	54.3	<0.1	-	20.7	-	21.7	<0.5
281	E-2-1	3/29	8.4	19.5	<0.1	-	73.6	-	8.54	<0.5
282	E-2-2	3/29	8.3	15.4	<0.1	-	8.85	-	3.72	<0.5
283	E-2-3	3/29	8.2	26.9	<0.1	-	10.0	-	8.69	<0.5
284	E-3-1	3/29	8.1	-	<0.1	-	5.65	-	2.83	-
285	E-3-2	3/29	8.0	-	<0.1	-	7.37	-	2.95	-
286	E-3-3	3/29	8.3	-	<0.1	-	6.04	-	3.25	-
287	E-4-1	3/29	8.3	-	<0.1	-	49.1	-	-	-
288	E-4-2	3/29	7.8	-	<0.1	-	10.7	-	-	-
289	E-4-3	3/29	7.9	-	<0.1	-	10.5	-	-	-
290	E-5-1	3/29	8.3	-	<0.1	-	-	-	-	-
291	E-5-2	3/29	8.3	-	<0.1	-	-	-	-	-
292	E-5-3	3/29	8.1	-	<0.1	-	-	-	-	-
293	E-6-1	3/29	6.9	-	<0.1	-	6.65	-	-	-
294	E-6-2	3/29	8.1	-	<0.1	-	8.39	-	-	-
295	E-6-3	3/29	7.7	-	<0.1	-	12.1	-	-	-
296	E-7-1	3/29	7.6	-	<0.1	-	5.84	-	<1.0	-
297	E-7-2	3/29	8.0	-	<0.1	-	15.0	-	27.3	-
298	E-7-3	3/29	7.4	-	<0.1	-	10.6	-	2.75	-
299	E-8-1	3/29	6.8	-	<0.1	2.31	<2.5	-	<1.0	-

SOUTHERN DIVISION NAVAL FACILITIES

DELIVERY ORDER # 0097

DRMO STORAGE SHED SOIL SAMPLES

CHARLESTON, SC NAVAL SHIPYARD

ETC #	Sample I.D.	Date	Results (as received ppm) pH	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Silver
212	B-6-1	3/28	5.7	<1.5	<0.1	3.34	8.35	-	<1.0	-
213	B-6-2	3/28	8.2	33.9	<0.1	26.3	16.7	-	10.0	-
214	B-6-3	3/28	8.4	74.9	<0.1	26.0	15.6	-	16.8	-
215	B-7-1	3/28	7.2	-	2.46	-	11.4	-	-	-
216	B-7-2	3/28	8.3	-	<0.1	-	9.61	-	-	-
217	B-7-3	3/28	8.2	-	<0.1	-	13.1	-	-	-
218	B-8-1	3/28	5.9	<1.5	<0.1	-	6.81	-	<1.0	-
219	B-8-2	3/28	8.0	11.7	0.72	-	8.13	-	<1.0	-
220	B-8-3	3/28	7.8	68.4	<0.1	-	11.9	-	14.2	-
221	B-9-1	3/28	5.5	-	-	-	-	-	-	-
222	B-9-2	3/28	8.0	-	-	-	-	-	-	-
223	B-9-3	3/28	8.1	-	-	-	-	-	-	-
224	C-1-1	3/28	8.5	10.2	<0.1	-	8.80	-	1.35	<0.5
225	C-1-2	3/28	8.6	26.9	<0.1	-	11.0	-	9.96	<0.5
226	C-1-3	3/28	8.4	62.8	<0.1	-	12.8	-	18.8	<0.5
227	C-2-1	3/28	7.3	7.15	<0.1	-	7.80	-	<1.0	-
228	C-2-2	3/28	8.4	15.3	<0.1	-	13.4	-	1.91	-
229	C-2-3	3/28	7.7	20.7	<0.1	-	21.1	-	2.07	-
230	C-3-1	3/28	7.1	-	3.25	-	<2.5	-	1.39	-
231	C-3-2	3/28	7.5	-	<0.1	-	12.5	-	1.69	-
232	C-3-3	3/28	7.9	-	<0.1	-	10.1	-	22.0	-
233	C-4-1	3/28	4.5	-	<0.1	-	<2.5	-	-	-
234	C-4-2	3/28	7.9	-	0.52	-	8.24	-	-	-
235	C-4-3	3/28	7.7	-	<0.1	-	11.7	-	-	-
236	C-5-1	3/29	5.2	<1.5	3.65	3.08	<2.5	-	<1.0	-
237	C-5-2	3/29	8.2	53.4	<0.1	31.9	9.88	-	16.6	-
238	C-5-3	3/29	8.1	78.5	<0.1	33.4	9.54	-	18.0	-
239	C-6-1	3/29	4.9	<1.5	<0.1	-	<2.5	-	1.45	-
240	C-6-2	3/29	8.4	8.31	<0.1	-	8.31	-	2.19	-
241	C-6-3	3/29	8.1	51.4	<0.1	-	17.4	-	15.2	-
242	C-7-1	3/29	5.3	-	<0.1	-	<2.5	-	<1.0	-
243	C-7-2	3/29	8.1	-	<0.1	-	21.1	-	13.0	-
244	C-7-3	3/29	8.1	-	<0.1	-	19.3	-	18.4	-
245	C-8-1	3/29	5.1	-	0.43	-	8.66	-	1.44	<0.5
246	C-8-2	3/29	8.0	-	<0.1	-	9.02	-	3.61	<0.5
247	C-8-3	3/29	8.3	-	<0.1	-	18.6	-	17.6	<0.5
248	C-9-1	3/29	8.1	12.8	<0.1	-	<2.5	-	1.56	<0.5
249	C-9-2	3/29	8.3	27.5	<0.1	-	14.7	-	15.6	<0.5
250	C-9-3	3/29	8.1	14.9	<0.1	-	11.2	-	9.33	<0.5
251	D-1-1	3/29	8.6	12.1	<0.1	-	12.6	-	5.80	<0.5
252	D-1-2	3/29	8.3	16.2	<0.1	-	12.3	-	2.45	<0.5
253	D-1-3	3/29	8.3	23.8	<0.1	-	15.3	-	18.8	<0.5
254	D-2-1	3/29	8.1	7.48	<0.1	-	9.97	-	2.99	<0.5

[illegible] [illegible]ATION NAVAL FACI[illegible]IES
[illegible] ORDER [illegible]
[illegible] DETECTION LIMITS

	METHOD DETECTION LIMIT (ppm)
2-AMINOPYRIDINE	1.0
HYDRAZINE	2.5
PENTACHLOROPHENOL	1.0
FORMALDEHYDE	1.0
PYRIDINE	1.0
CRESOL (TOTAL)	1.0

	METHOD DETECTION LIMIT (ppb)
METHYLENE CHLORIDE	5.0
CHLOROFORM	5.0
1,1,1-TRICHLOROETHANE	5.0
CARBON TETRACHLORIDE	5.0
1,2-DICHLOROETHANE	5.0
TRICHLOROETHYLENE	5.0
TETRACHLOROETHYLENE	5.0
TOLUENE	5.0
DICHLOROFLUOROMETHANE	5.0
TRICHLOROFLUOROMETHANE	5.0
DIETHYL ETHER	5.0
METHYL ETHYL KETONE	5.0
METHYL ISOBUTYL KETONE	5.0
ETHYLENE OXIDE	5.0

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER 0037 - DPDO STORAGE SHED
SOIL SAMPLES

SAMPLE ID	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9
SAMPLE DATE	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05	10/05/87	10/05/87	10/05/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	11.2	BDL	75.8	BDL	57.6	BDL	BDL	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible] - DRMO STORAGE SHED
SOIL SAMPLES

SAMPLE ID	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9
SAMPLE DATE	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	BDL	15.3	42.3	BDL	15.2	BDL	6.3	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible] - DRMO STORAGE SHED
SOIL SAMPLES

SAMPLE ID	D-9	D-8	D-7	D-6	D-5	D-4	D-3	D-2	D-1
SAMPLE DATE	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87	10/05/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLORODIFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	50.5	7.7	BDL	BDL	BDL	BDL	8.2	9.7	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible] - DFMO STORAGE [illegible]
SOIL SAMPLES

SAMPLE ID	D-1	D-2	D-3	D-4	D-5	D-6	D-7	D-8	D-9
SAMPLE DATE	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLORODIFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	6.3	16.3	48.9	5.9	24.1	24.1	17.9	BDL	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible] - DRMO STORAGE SHED
SOIL SAMPLES

SAMPLE ID	E-9	E-8	E-7	E-6	E-5	E-4	E-3	E-2	E-1
SAMPLE DATE	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLORODFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	BDL	BDL	BDL	13.4	17.9	26.6	BDL	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible] - DRMO STORAGE SHED
SOIL SAMPLES

SAMPLE ID	ST-1	ST-2	ST-3	ST-4	ST-5	ST-6	ST-7	ST-8
SAMPLE DATE	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87	10/06/87
(as received ppm)								
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)								
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	8.1	BDL	BDL	29.6	BDL	BDL	BDL	7.4
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER 0083
MATRIX SPIKE RESULTS

	A-9					C-8					D-5				
	SAMPLE RESULT	SPK	EXP	FND	% REC	SAMPLE RESULT	SPK	EXP	FND	% REC	SAMPLE RESULT	SPK	EXP	FND	% REC
(as received ppm)															
HYDRAZINE	BDL	67.4	67.4	40.7	47	BDL	67.4	67.4	26.8	40	BDL	67.4	67.4	47.8	71
PYRIDINE	BDL	72.4	72.4	31.7	44	BDL	72.4	72.4	15.3	21	BDL	72.4	72.4	64.6	89
O-CRESOL	BDL	35.2	35.2	38.7	110	BDL	35.2	35.2	19.9	56	BDL	35.2	35.2	27.8	79
(as received ppb)															
METHYLENE CHLORIDE	BDL	9.9	9.9	4.3	44	BDL	9.9	9.9	4.4	42	BDL	6.6	6.6	2.9	44
CHLOROFORM	BDL	11.2	11.2	4.9	44	BDL	11.2	11.2	4.9	44	BDL	7.5	7.5	3.6	48
1,1,1-TRICHLOROETHANE	BDL	10.0	10.0	2.1	21	BDL	10.0	10.0	2.6	26	BDL	6.7	6.7	2.4	34
CARBON TETRACHLORIDE	BDL	12.0	12.0	3.1	26	BDL	12.0	12.0	2.3	20	BDL	8.0	8.0	3.3	41
1,2-DICHLOROETHANE	BDL	9.2	9.2	5.9	64	BDL	9.2	9.2	6.2	67	BDL	6.3	6.3	5.1	81
TRICHLOROETHYLENE	BDL	11.0	11.0	3.8	35	BDL	11.0	11.0	3.9	36	BDL	6.7	6.7	2.3	34
TETRACHLOROETHYLENE	BDL	12.2	12.2	4.2	35	BDL	12.2	12.2	4.5	37	BDL	8.1	8.1	2.9	36
TOLUENE	BDL	12.9	12.9	7.0	54	BDL	12.9	12.9	6.9	54	BDL	8.6	8.6	4.2	49
DIETHYL ETHER	BDL	141	141	108	77	BDL	141	141	86.9	61	BDL	48.6	48.6	35.5	73
METHYL ETHYL KETONE	BDL	160	160	**	**	BDL	160	160	158	98	BDL	40.0	40.0	18.6	47
METHYL ISOBUTYL KETONE	BDL	160	160	123	77	BDL	160	160	110	69	BDL	40.0	40.0	41.6	104

	E-1					ST-8				
	SAMPLE RESULT	SPK	EXP	FND	% REC	SAMPLE RESULT	SPK	EXP	FND	% REC
(as received ppm)										
HYDRAZINE	BDL	67.4	67.4	59.9	57	BDL	67.4	67.4	31.7	47
PYRIDINE	BDL	72.4	72.4	38.6	53	BDL	72.4	72.4	14.3	20
O-CRESOL	BDL	35.2	35.2	22.4	64	BDL	35.2	35.2	14.4	41
(as received ppb)										
METHYLENE CHLORIDE	BDL	6.6	6.6	5.0	76	BDL	6.6	6.6	4.1	62
CHLOROFORM	BDL	7.5	7.5	6.6	88	BDL	7.5	7.5	5.2	69
1,1,1-TRICHLOROETHANE	BDL	6.7	6.7	3.7	55	BDL	6.7	6.7	3.2	48
CARBON TETRACHLORIDE	BDL	8.0	8.0	3.4	43	BDL	8.0	8.0	3.1	40
1,2-DICHLOROETHANE	BDL	6.3	6.3	4.7	75	BDL	6.3	6.3	4.8	76
TRICHLOROETHYLENE	BDL	6.7	6.7	4.3	70	BDL	6.7	6.7	3.8	57
TETRACHLOROETHYLENE	BDL	8.1	8.1	5.2	64	BDL	8.1	8.1	3.1	39
TOLUENE	BDL	8.6	8.6	4.7	55	BDL	8.6	8.6	4.1	48
DIETHYL ETHER	BDL	141	141	110	78	7.2	141	148	101	68
METHYL ETHYL KETONE	BDL	35.0	35.0	33.0	96	BDL	160	160	109	68
METHYL ISOBUTYL KETONE	BDL	160	160	158	99	BDL	160	160	118	74

SPK -- SPIKE
EXP - EXPECTED
FND - FOUND
% REC - % RECOVERY
BDL - BELOW DETECTION LIMIT
** - NOT DETECTED DUE TO MATRIX INTERFERENCE

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER 0093
DUPLICATE RESULTS SUMMARY

	A-9			C-8			D-8			E-1			ST-8		
	1ST	2ND	% DUP	1ST	2ND	% DUP	1ST	2ND	% DUP	1ST	2ND	% DUP	1ST	2ND	% DUP
(as received ppm)															
2-AMINOPYRIDINE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
HYDRAZINE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
PENTACHLOROPHENOL	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
FORMALDEHYDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
PYRIDINE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
CRESOL (TOTAL)	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
(as received ppb)															
METHYLENE CHLORIDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
CHLOROFORM	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
1,1,1-TRICHLOROETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
CARBON TETRACHLORIDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
1,2-DICHLOROETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TRICHLOROETHYLENE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TETRACHLOROETHYLENE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TOLUENE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
DICHLOROFLUOROMETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TRICHLOROFLUOROETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TRICHLOROFLUOROMETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
DIETHYL ETHER	BDL	BDL	100	7.7	6.0	80	BDL	BDL	100	BDL	BDL	100	7.4	6.9	93
METHYL ETHYL KETONE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
METHYL ISOBUTYL KETONE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
ETHYLENE OXIDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100

1ST = ORIGINAL SAMPLE
2ND - DUPLICATE

APPENDIX E

PESTICIDE MIXING AREA - ANALYTICAL DATA

(Source: Reference 12)

pH MEASUREMENTS OF WATER SAMPLES
COLLECTED FROM MONITOR WELLS AT THE
PESTICIDE-MIXING AREA,
FEBRUARY 12, 1982[1]

Well Number	pH
WPA-1	6.02
WPA-2	6.04

[1] Measured at the time of sample collection.

ENERGY RESOURCES CO. INC

INORGANIC ANALYSIS

- Report Sheet -
- µg/l

Analyzed for: Geraghty & Miller
Sediments - waters

ERCO ID	CLIENT ID	As
IC-82-		
	Waters	µg/l
576	WPA-1	<10
577	WPA-2	<10
577 ERCO	DUPLICATE	<10

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID#.

Sample Rcvd. 2/17/82 Reported by Lae

Date Analysis Completed 3/16/82 Checked by [illegible]

ENERGY RESOURCES CO. INC

INORGANIC ANALYSIS

- Report Sheet -
μg/gm dry wgt.

Analyzed for: Geraghty & Miller
Sediments

ERCO ID	CLIENT ID	As
IC-82		
554	PA-1	6.3
555	PA-2	2.8
556	PA-3	3.9
556	ERCO DUPLICATE	3.0
557	PA-4	1.1
558	PA-5	2.9
559	PA-6	4.2
560	PA-7	5.7
561	PA-8	4.8

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID#.

Sample Rcvd. 2/17/82 Reported by Lau

Date Analysis Completed 3/16/82 Checked by MEL

ENERGY RESOURCES CO. INC.

HERBICIDE ANALYSES

		2,4-D (µg/l)		2,4,5-TP (µg/l)	
ERCO ID	G&M ID	Det. Limit	Conc.	Det. Limit	Conc.
28-552	WPA-1	0.05	ND	0.02	ND
28-553	WPA-2	0.05	ND	0.02	ND
28-554	PA-1	5.0	ND	1.5	ND
28-555	PA-2	5.0	ND	1.5	ND
28-556	PA-3	5.0	ND	1.5	ND
28-557	PA-4	5.0	ND	1.5	ND
28-558	PA-5	5.0	ND	1.5	ND
28-559	Soil Blank	5.0	ND	1.5	ND
28-560	PA-7	5.0	ND	1.5	ND
28-561	PA-8	5.0	ND	1.5	ND
28-562	PA-9	5.0	ND	1.5	ND

ND = none detected

Reported by: George Peng

Checked by: ADW

[redacted]

Date Analysis Completed: 3/25/82

Analyzed for: Compounds	Client ID	WPA-1 28-552	WPA-2 28-553	PA-1 28-554	PA-2 28-555	PA-3 28-556	PA-4 28-557	PA-5 28-558	blank 28-559	PA-6 28-560	PA-7 28-561	PA-8 28-561
1. 89P	aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2. 90P	dieldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3. 91P	chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4. 92P	4,4'-DDT	ND	ND	100	40	880	7	6	ND	20	200	4
5. 93P	4,4'-DDE	ND	ND	230	40	350	4	7	ND	15	250	3
6. 94P	4,4'-DDD	ND	ND	11	7	150	ND	ND	ND	1	18	ND
7. 95P	α-endosulfan	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
8. 96P	β-endosulfan	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
9. 97P	endosulfan sulfate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10. 98P	endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
11. 99P	endrin aldehyde	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12. 100P	heptachlor	ND	ND	ND	ND	2	ND	ND	ND	ND	1.0	ND
13. 101P	heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
14. 102P	α-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
15. 103P	β-BHC	ND	ND	ND	ND	1	ND	ND	ND	ND	1	ND
16. 104P	γ-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
17. 105P	δ-BHC	ND	ND	ND	ND	2	ND	ND	ND	ND	1	ND
18. 106P	PCB-1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19. 107P	PCB-1254	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
20. 108P	PCB-1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
21. 109P	PCB-1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22. 110P	PCB-1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
23. 111P	PCB-1260	ND	ND	39	ND	100	2	2	ND	7	36	1
24. 112P	PCB-1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
25. 113P	toxaphene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Reported by: Elli

ENVIRONMENTAL
SCIENCE
CORPORATION

P.O. BOX 616
NUT STREET • MIDDLETOWN, CONN. 06457
TELEPHONE: 347-6961

Laboratory Report

LAB REPORT NO C-0440

State Certification No PH-0-

CLIENT
Commanding Officer
Southern Division
Naval Facilities Command
2144 Melbourne Street
P.O. Box 10068
Charleston, S.C. 29411

DATE May 17, 1982

CLIENT PHONE NO (803) 743-5510

SPECIAL INSTRUCTIONS

0004

SAMPLE DESCRIPTION	TEST	RESULTS	
Pesticide Mixing Area 2" Sample #1	D,P DDT	5.3	µg/ml (ppm)
	P,P DDT	<0.01	µg/gr (ppm)
	DDT total	5.3	µg/ml
	2,4 D	<0.01	µg/gr (ppm)
	2,4,5 TP (Silvex)	0.51	µg/gr (ppm)
Pesticide Mixing Area 2" Sample #2	D,D DDT	0.08	µg/gr
	P,P DDT	1.4	µg/gr
	Total DDT	1.48	µg/gr (ppm)
	2,4 D	0.09	µg/gr (ppm)
	2,4,5 TP (Silvex)	<0.01	µg/gr (ppm)

ANALYSES OF SOIL SAMPLES COLLECTED BY NAVAL PERSONNEL, May 1982.

REMARKS

APPENDIX F

PUBLIC WORKS YARD - ANALYTICAL DATA

Prior to Partial Closure

Analytical Data - March 28, 1986

Note: Background samples were collected from each of three residential areas within the Naval Shipyard itself. Those samples (labeled BK1, BK2, BK3) were collected from:

* near officers quarters EE, at the intersection of Avenue G and Second Street West;

* near officers quarters Y/Z, at the intersection of Hobson Avenue and Pine Street; and

* near the tennis courts (NS48, 49) adjacent to enlisted quarters at the intersection of Partridge Avenue, Osprey Street and East Avenue.

Source: EnSafe. July 11, 1986. Evaluation of Soil Contamination at the Interim Status Storage Facility 'Old Corral'.

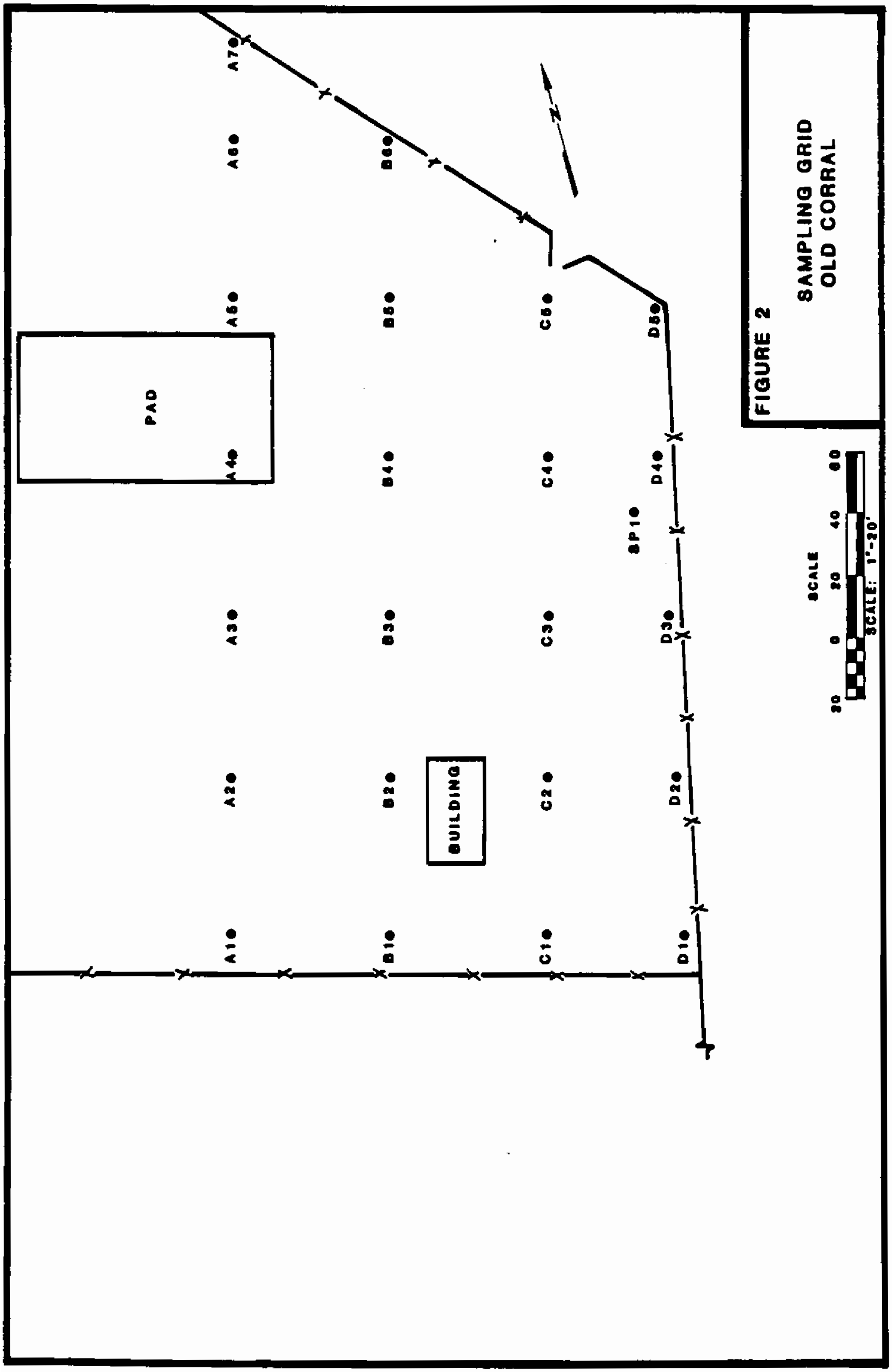


FIGURE 2
SAMPLING GRID
OLD CORRAL

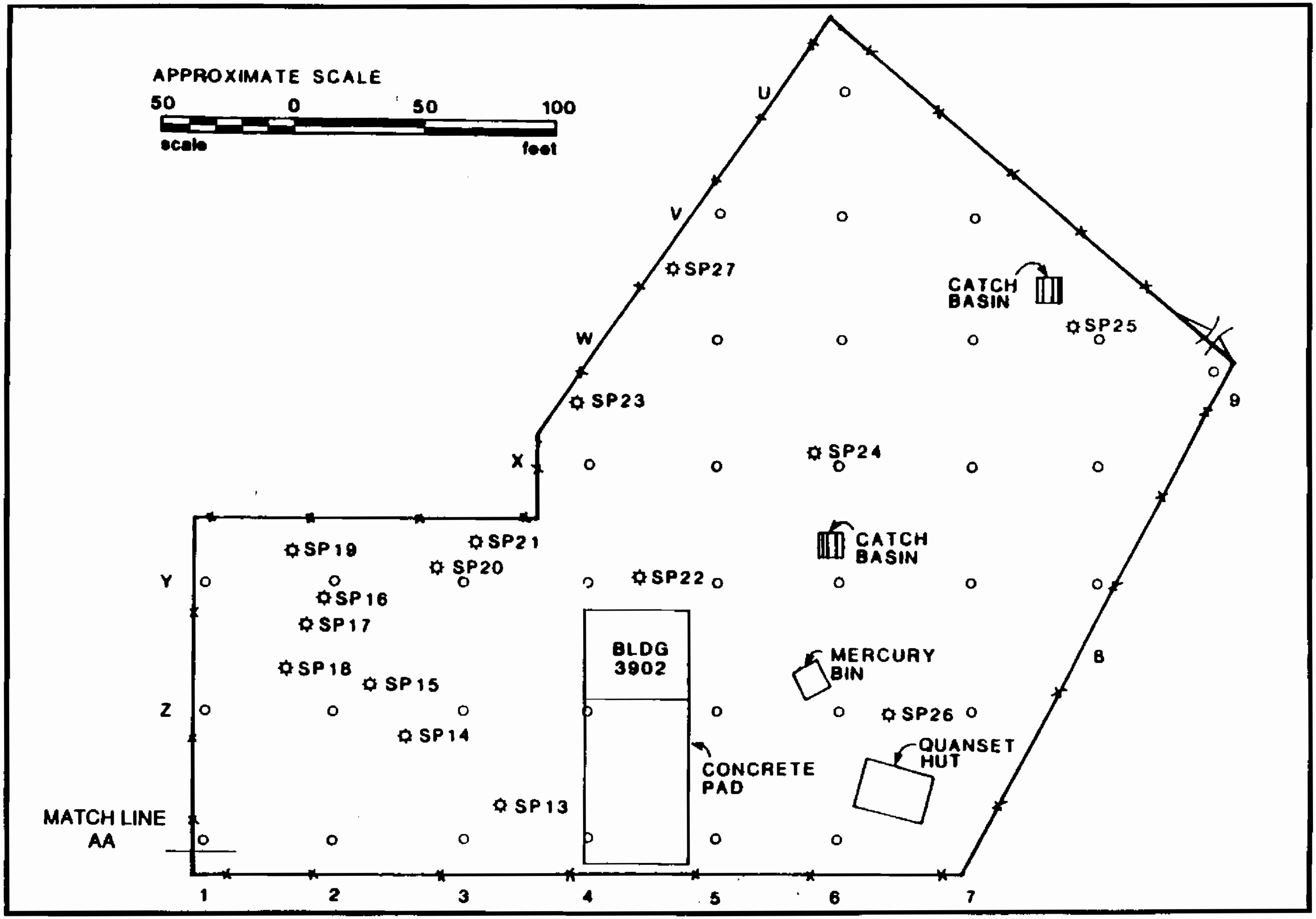


Figure 2-16. Sampling stations, public works storage yard. (Figure taken from Reference 5.)

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 emical Analysis

Laboratory Certification Number 10120

CLIENT: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY: GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

PARAMETER				
	SAMPLE ID :	BK1	BK2	BK3
	LAB ID :	86030866	86030867	86030868
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86
PH - LAB		4.88 § 25C	5.30 § 25C	5.99 § 24C
FLASH POINT, c.c.		>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		31.9 ppm	16.3 ppm	11.2 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		0.71 ppm	0.59 ppm	0.93 ppm
CHROMIUM		8.08 ppm	3.90 ppm	15.6 ppm
AD		119 ppm	28.8 ppm	20.9 ppm
RCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		2.88 ppm	2.49 ppm	6.35 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm
OCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm
OCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	BK1	BK2	BK3
	LAB ID :	86030866	86030867	86030868
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm

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MEMPHIS , TN 38184
CONTACT: MR. J. SPEAKMAN, PhD, PE

DATE: 04/08/86

RELEASED BY: GEORGE C. GREENE PE, PHD

CLIENT CODE: ENSA

PARAMETER				
SAMPLE ID :	A1	A2	A3	A4
LAB ID :	86030831	86030832	86030833	86030834
DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB	6.90 $ 24C	3.55 $ 24C	7.70 $ 24C	7.30 $ 24C
FLASH POINT, c.c.	>140 F	>140 F	>140 F	>140 F
CYANIDE	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES	2.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM	31.8 ppm	63.0 ppm	24.5 ppm	29.6 ppm
BERYLLIUM	<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM	2.52 ppm	4.17 ppm	1.76 ppm	2.38 ppm
CHROMIUM	16.0 ppm	22.7 ppm	16.3 ppm	14.6 ppm
LEAD	112 ppm	180 ppm	141 ppm	91.6 ppm
MERCURY	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL	12.5 ppm	11.1 ppm	7.46 ppm	5.24 ppm
SELENIUM	<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL	<1 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL	<1 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM	<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER	<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016	<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221	<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/08/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	A1	A2	A3	A4
	LAB ID :	86030831	86030832	86030833	86030834
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	117 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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CONTACT: MR. J. SPEAKMAN, PhD, PE

DATE: 04/08/86

RELEASED BY:
GEORGE C. GREENE PE, PHD

CLIENT CODE: ENSA

	SAMPLE ID :	A5	A6	A7	B1
	LAB ID :	86030835	86030836	86030837	86030838
PARAMETER	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB		6.40 $ 24C	7.60 $ 24C	7.50 $ 24C	8.10 $ 24C
FLASH POINT, c.c.		>140 F	>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		26.7 ppm	18.3 ppm	18.7 ppm	52.2 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		2.02 ppm	1.60 ppm	2.39 ppm	1.88 ppm
CHROMIUM		12.2 ppm	25.0 ppm	24.1 ppm	10.0 ppm
LEAD		33.0 ppm	101 ppm	71.5 ppm	51.1 ppm
MERCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		5.26 ppm	7.14 ppm	12.6 ppm	6.54 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/08/86
CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	A5	A6	A7	B1
	LAB ID :	86030835	86030836	86030837	86030838
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		34.2 ppm	9.1 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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RELEASED BY: GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

PARAMETER	B2	B3	B4	B5
SAMPLE ID :	B2	B3	B4	B5
LAB ID :	86030839	86030840	86030841	86030842
DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB	5.95 $ 26C	7.39 $ 25C	7.70 $ 24C	7.90 $ 24C
FLASH POINT, c.c.	>140 F	>140 F	>140 F	>140 F
CYANIDE	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM	170 ppm	10.0 ppm	31.7 ppm	15.8 ppm
BERYLLIUM	<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM	2.04 ppm	1.14 ppm	1.79 ppm	1.82 ppm
CHROMIUM	14.5 ppm	8.0 ppm	14.0 ppm	19.5 ppm
LEAD	232 ppm	156 ppm	94.2 ppm	69.9 ppm
'ERCURY	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CKEL	11.3 ppm	3.82 ppm	5.25 ppm	5.78 ppm
ↄELENIUM	<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL	8.4 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL	16.2 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM	<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER	<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016	<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
`ROCLOR 1221	<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/08/86

	SAMPLE ID :	B2	B3	B4	B5
	LAB ID :	86030839	86030840	86030841	86030842
PARAMETER	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY: GEORGE C. GREENE PE, PHD

CLIENT CODE: ENSA

PARAMETER	SAMPLE ID :	B6	C1	C2	C3
	LAB ID :	86030843	86030844	86030845	86030846
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB		7.00 § 26C	6.61 § 24C	6.40 § 24C	7.50 § 24C
FLASH POINT, c.c.		>140 F	>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		17.0 ppm	142 ppm	380 ppm	14.1 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		2.72 ppm	2.88 ppm	1.16 ppm	<0.20 ppm
CHROMIUM		37.5 ppm	19.8 ppm	63.1 ppm	9.42 ppm
LEAD		141 ppm	331 ppm	508 ppm	62.5 ppm
MERCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		9.72 ppm	16.2 ppm	5.12 ppm	3.92 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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CONTACT: MR. J. SPEAKMAN, PhD, PE

	SAMPLE ID :	B6	C1	C2	C3
	LAB ID :	86030843	86030844	86030845	86030846
PARAMETER	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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Laboratory Certification Number 10120

CLIENT: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY:
GEORGE C. GREENE PE, PHD

CLIENT CODE: ENSA

	SAMPLE ID :	C4	C5	D1	D2
	LAB ID :	86030847	86030848	86030849	86030850
PARAMETER	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB		7.20 $ 24C	7.70 $ 26C	6.80 $ 26C	7.20 $ 26C
FLASH POINT, c.c.		>140 F	>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		13.8 ppm	22.5 ppm	23.5 ppm	55.3 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		1.54 ppm	1.24 ppm	1.81 ppm	3.46 ppm
CHROMIUM		3.09 ppm	23.8 ppm	16.8 ppm	31.2 ppm
LEAD		96.8 ppm	131 ppm	75.1 ppm	180 ppm
MERCURY		1.6 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		3.68 ppm	9.58 ppm	8.62 ppm	15.0 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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MEMPHIS , TN 38184

DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	C4	C5	D1	D2
	LAB ID :	86030847	86030848	86030849	86030850
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	2.0 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY: GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

PARAMETER		D3	D4	D5	SP1
	SAMPLE ID :	D3	D4	D5	SP1
	LAB ID :	86030851	86030852	86030853	86030854
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB		7.00 § 24C	6.88 § 24C	6.11 § 24C	7.10 § 25C
FLASH POINT, c.c.		>140 F	>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		31.9 ppm	24.8 ppm	26.7 ppm	13.5 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		2.78 ppm	8.70 ppm	3.10 ppm	2.23 ppm
CHROMIUM		70.3 ppm	38.3 ppm	31.8 ppm	24.0 ppm
LEAD		162 ppm	90.6 ppm	81.0 ppm	126 ppm
MERCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		13.8 ppm	15.4 ppm	12.4 ppm	14.0 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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MEMPHIS , TN 38184

DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER		D3	D4	D5	SP1
	SAMPLE ID :	D3	D4	D5	SP1
	LAB ID :	86030851	86030852	86030853	86030854
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm	3.3 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY:
GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

PARAMETER	SAMPLE ID :	SP2	SP3	SP4	SP5
	LAB ID :	86030855	86030856	86030857	86030858
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB		6.20 @ 24C	7.50 @ 24C	7.70 @ 24C	7.30 @ 24C
FLASH POINT, c.c.		>140 F	>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		13.5 ppm	22.7 ppm	57.2 ppm	35.0 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		0.56 ppm	0.91 ppm	1.63 ppm	1.28 ppm
CHROMIUM		8.00 ppm	21.9 ppm	18.3 ppm	17.8 ppm
LEAD		7.39 ppm	2400 ppm	506 ppm	369 ppm
MERCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		4.19 ppm	4.27 ppm	8.10 ppm	6.73 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		6.2 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		3.5 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/10/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	SP2	SP3	SP4	SP5
	LAB ID :	86030855	86030856	86030857	86030858
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		2.9 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm	1.7 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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MEMPHIS , TN 38184
CONTACT: MR. J. SPEAKMAN, PhD, PE

DATE: 04/10/86

RELEASED BY: GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

	SAMPLE ID :	SP6	SP7	SP8	SP9
	LAB ID :	86030859	86030860	86030861	86030862
PARAMETER	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
PH - LAB		7.10 § 24C	7.35 § 24C	8.28 § 25C	8.30 § 25C
FLASH POINT, c.c.		>140 F	>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		56.2 ppm	41.7 ppm	50.1 ppm	12.9 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		1.57 ppm	0.92 ppm	1.16 ppm	0.72 ppm
CHROMIUM		19.7 ppm	32.0 ppm	18.2 ppm	10.6 ppm
LEAD		323 ppm	774 ppm	293 ppm	77.6 ppm
MERCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		9.33 ppm	4.10 ppm	11.5 ppm	2.39 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	SP6	SP7	SP8	SP9
	LAB ID :	86030859	86030860	86030861	86030862
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	1.9 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm	<0.5 ppm

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CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY: GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

PARAMETER		SP10	SP11	SP12
	SAMPLE ID :	SP10	SP11	SP12
	LAB ID :	86030863	86030864	86030865
PARAMETER	DATE RECEIVED:	03/28/86	03/28/86	03/28/86
PH - LAB		8.20 § 24C	8.18 § 24C	7.40 § 24C
FLASH POINT, c.c.		>140 F	>140 F	>140 F
CYANIDE		<1.0 ppm	<1.0 ppm	<1.0 ppm
SULFIDES		<1.0 ppm	<1.0 ppm	<1.0 ppm
BARIUM		30.7 ppm	33.9 ppm	20.4 ppm
BERYLLIUM		<2.0 ppm	<2.0 ppm	<2.0 ppm
CADMIUM		1.30 ppm	3.69 ppm	1.32 ppm
CHROMIUM		18.0 ppm	18.3 ppm	14.3 ppm
LEAD		82.1 ppm	737 ppm	222 ppm
MERCURY		<1.0 ppm	<1.0 ppm	<1.0 ppm
NICKEL		7.29 ppm	7.98 ppm	6.87 ppm
SELENIUM		<0.2 ppm	<0.2 ppm	<0.2 ppm
SILVER		<1.0 ppm	<1.0 ppm	<1.0 ppm
CRESOL		<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<1 ppm	<1 ppm	<1 ppm
CARBON TETRACHLORIDE		<1 ppm	<1 ppm	<1 ppm
CHLOROFORM		<1 ppm	<1 ppm	<1 ppm
DICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm
ETHYLENE DICHLORIDE		<1 ppm	<1 ppm	<1 ppm
METHYL ETHYL KETONE		<1 ppm	<1 ppm	<1 ppm
METHYL ISOBUTYL KETONE		<1 ppm	<1 ppm	<1 ppm
METHYLENE CHLORIDE		<1 ppm	<1 ppm	<1 ppm
TETRACHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm
TOLUENE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHANE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROETHYLENE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROETHANE		<1 ppm	<1 ppm	<1 ppm
TRICHLOROFLUOROMETHANE		<1 ppm	<1 ppm	<1 ppm
AMINO PYRIDINE		<1 ppm	<1 ppm	<1 ppm
DIETHYL ETHER		<1 ppm	<1 ppm	<1 ppm
ETHYLENE OXIDE		<1 ppm	<1 ppm	<1 ppm
FORMALDEHYDE		<1 ppm	<1 ppm	<1 ppm
HYDRAZINE		<1 ppm	<1 ppm	<1 ppm
PYRIDINE		<1 ppm	<1 ppm	<1 ppm
AROCLOR 1016		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm	<0.5 ppm

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DATE: 04/10/86

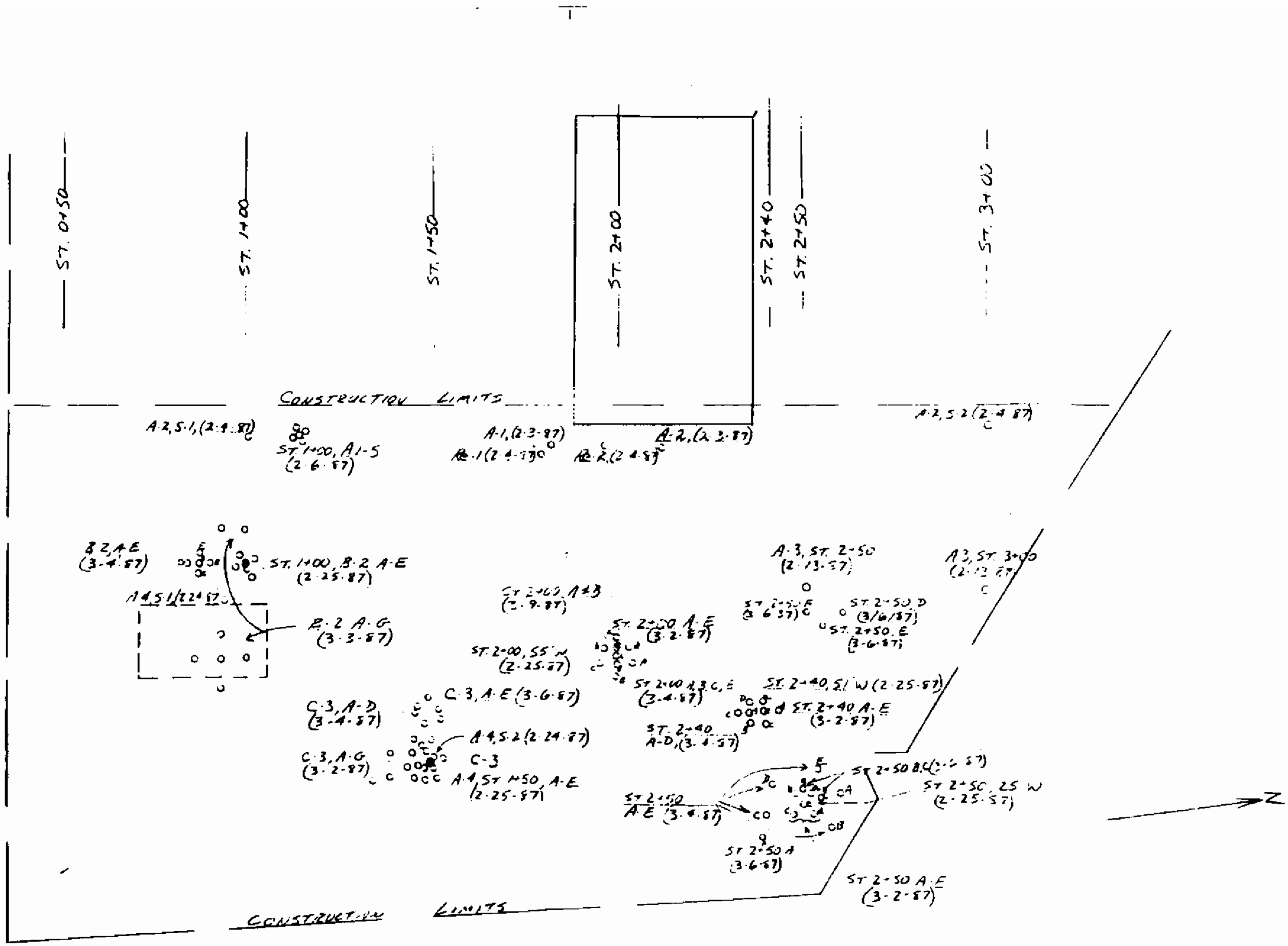
CONTACT: MR. J. SPEAKMAN, PhD, PE

PARAMETER	SAMPLE ID :	SP10	SP11	SP12
	LAB ID :	86030863	86030864	86030865
	DATE RECEIVED:	03/28/86	03/28/86	03/28/86
AROCLOR 1232		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm	<0.5 ppm

Subsequent to Partial Closure

Completed 1986

Cold Storage Warehouse (Building #193)



GENERAL ENGINEERING LABORATORIES engineering consulting & chemical analysis 1313 Ashley River Rd. Charleston, S.C. 29407 (803) 556-8171	DRAWN BY ALBRIGHT	CHECKED BY	CLIENT CODE	DATE	
	REV NO	DATE	CHECKED BY	PROJECT SAMPLE SITE HAZARDOUS WASTE STORAGE YARD CHARLESTON NAVAL SHIPYARD	DRAWING 1

4/2
1142

DEPARTMENT OF THE NAVY
CHARLESTON NAVAL SHIPYARD
NAVAL BASE
CHARLESTON, S. C. 29408

IN REPLY REFER TO

5090
Ser 461/172
30 MAR 1987

Mr. David C. Price, P.E.
South Carolina Department of Health
and Environmental Control
Bureau of Solid and Hazardous Waste
2600 Bull Street
Columbia, SC 29201

RE: Charleston Naval Shipyard
Charleston County
EPA ID #SC0170022560

Dear Mr. Price:

Partial closure of the Public Works storage yard has been completed. Attached are two copies of the certification document for your review.

Construction of a cold storage warehouse addition is scheduled to begin on April 6, 1987 on this site. Therefore, we request an expedient response of concurrence from your department so no government delays will be incurred.

If you have any questions, contact John Sneed or Alan Shoultz at (803) 743-5519.

Sincerely,

D. H. Hines

D. H. HINES
Captain, USN
Commander,
Charleston Naval Shipyard

Encl:
(1) Closure Certification (2)

Copy to:
Commanding Officer,
Southern Division
Naval Facilities Engineering Command (Code 114)

CLOSURE CERTIFICATION

FOR
PARTIAL CLOSURE OF THE
HAZARDOUS WASTE STORAGE YARD
CHARLESTON NAVAL SHIPYARD
CHARLESTON, SOUTH CAROLINA

I certify that I have personally reviewed the following plans for closure of the Hazardous Waste Storage Yard at the Charleston Naval Shipyard in Charleston, South Carolina.

Charleston Naval Shipyard Charleston, SC Closure Plans Interim Status Facilities, dated May 27, 1986 and approved by the South Carolina Department of Health and Environmental Control in a letter from Mr. David Price to Mr. J.W. Sneed, dated October 22, 1986;

Section 02099 of Navy Plans and Specifications for Construction Contract No. 06-86-0589 entitled Hazardous Waste Storage Yard Partial Closure Plan.

On March 20, 1987 I had a telephone conversation with Mr. Mark Taylor of the Southern Division Naval Facilities Engineering Command concerning the above referenced closure plans. During that conversation, Mr. Taylor informed me of the established contaminant threshold limits which had been approved by the South Carolina Department of Health and Environmental Control.

Samples were collected on February 3, 4, 6, 13, 24, 25, 1987 and March 2, 3, 4, 6, 9, 1987 by General Engineering Laboratories field personnel in accordance with the approved plans. The sample locations are indicated in Drawing No. 1. These samples were analyzed by General Engineering Laboratories analytical personnel in accordance with the approved plans. The results of the analyses are attached herewith.

Based on my review of the sampling procedures, comparison of the analytical data with established threshold limits, and conversations with field technicians, I certify that partial closure of the Hazardous Waste Storage Yard has been accomplished in accordance with the above referenced closure plans and specifications.

Date: 3/23/87

Engineer: [signature]
George C. Greene, P.E., Ph.D.
SC Reg. No. 9103

Owner: [signature]
D. H. Hines, Capt, USN
Commander

fc: aewc032087

Engineering Consulting
Chemical Analysis

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1313 Ashley River Road
Charleston, S.C. 29407
P.O. Box 30712
Charleston, S.C. 29417
Phone (803) 556-8171

Laboratory Certification Number 10120

CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 02/06/87

RELEASED BY: for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER		
SAMPLE ID :	A-1	A-2
LAB ID :	87020117	87020118
DATE RECEIVED:	02/03/87	02/03/87
BARIUM	34.8 ppm	23.6 ppm
CADMIUM	0.38 ppm	0.20 ppm
CHROMIUM	6.73 ppm	9.33 ppm
LEAD	15.6 ppm	19.6 ppm
ACID DIGESTION	YES	YES
CRESOL	<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm	<1.0 ppm
AROCLOR 1016	<1 ppm	<1 ppm
AROCLOR 1221	<1 ppm	<1 ppm
AROCLOR 1232	<1 ppm	<1 ppm
AROCLOR 1242	<1 ppm	<1 ppm
AROCLOR 1248	<1 ppm	<1 ppm
AROCLOR 1254	<1 ppm	<1 ppm
AROCLOR 1260	<1 ppm	<1 ppm
AROCLOR 1262	<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 02/06/87
RELEASED BY: A.M. Crane
for GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER	SAMPLE ID :	AREA 2 SAMPLE #1	AREA 2 SAMPLE #2
	LAB ID :	87020163	87020164
	DATE RECEIVED:	02/04/87	02/04/87
BARIUM		16.0 ppm	17.4 ppm
CADMIUM		0.40 ppm	0.79 ppm
CHROMIUM		24.5 ppm	18.7 ppm
LEAD		483 ppm	50.6 ppm
ACID DIGESTION		YES	YES
CRESOL		<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL		<1.0 ppm	<1.0 ppm
AROCLOR 1016		<1 ppm	<1 ppm
AROCLOR 1221		<1 ppm	<1 ppm
AROCLOR 1232		<1 ppm	<1 ppm
AROCLOR 1242		<1 ppm	<1 ppm
AROCLOR 1248		<1 ppm	<1 ppm
AROCLOR 1254		<1 ppm	<1 ppm
AROCLOR 1260		<1 ppm	<1 ppm
AROCLOR 1262		<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION		YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 02/09/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: AM Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER					
	SAMPLE ID :	STA. 100 AREA 1 6"	STA. 100 AREA 2 6"	STA. 100 AREA 3 6"	STA. 100 AREA 4 6"
	LAB ID :	87020240	87020241	87020242	87020243
PARAMETER	DATE RECEIVED:	02/06/87	02/06/87	02/06/87	02/06/87
BARIUM		22.9 ppm	48.6 ppm	14.9 ppm	9.80 ppm
CADMIUM		<0.20 ppm	<0.20 ppm	0.53 ppm	<0.20 ppm
CHROMIUM		8.44 ppm	3.33 ppm	3.36 ppm	4.67 ppm
LEAD		26.2 ppm	50.2 ppm	28.5 ppm	21.6 ppm
ACID DIGESTION		YES	YES	YES	YES
CRESOL		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL		<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
AROCLOR 1016		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1221		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1232		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1242		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1248		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1254		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1260		<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1262		<1 ppm	<1 ppm	<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 02/09/87

RELEASED BY:
for: GEORGE E. GREENE PE,PHD

CC/FC: AEWC/AEWC1

SAMPLE ID : STA. 100
AREA 5
18"
LAB ID : 87020244
PARAMETER DATE RECEIVED: 02/06/87

PARAMETER	STA. 100 AREA 5 18"
BARIUM	21.9 ppm
CADMIUM	0.27 ppm
CHROMIUM	8.04 ppm
LEAD	40.2 ppm
ACID DIGESTION	YES
CRESOL	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm
AROCLOR 1016	<1 ppm
AROCLOR 1221	<1 ppm
AROCLOR 1232	<1 ppm
AROCLOR 1242	<1 ppm
AROCLOR 1248	<1 ppm
AROCLOR 1254	<1 ppm
AROCLOR 1260	<1 ppm
AROCLOR 1262	<1 ppm
EXTRACTION & CONCENTRATION	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 02/13/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: W. Byron
for GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER		
SAMPLE ID :	AREA 3 ST-2+50 50' EAST	AREA 3 ST-3+00 50' EAST
LAB ID :	87020481	87020482
DATE RECEIVED:	02/13/87	02/13/87
BARIUM	20.0 ppm	16.3 ppm
CADMIUM	0.73 ppm	1.17 ppm
CHROMIUM	14.0 ppm	17.8 ppm
LEAD	66.9 ppm	36.0 ppm
ACID DIGESTION	YES	YES
CRESOL	<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm	<1.0 ppm
AROCLOR 1016	<1 ppm	<1 ppm
AROCLOR 1221	<1 ppm	<1 ppm
AROCLOR 1232	<1 ppm	<1 ppm
AROCLOR 1242	<1 ppm	<1 ppm
AROCLOR 1248	<1 ppm	<1 ppm
AROCLOR 1254	<1 ppm	<1 ppm
AROCLOR 1260	<1 ppm	<1 ppm
AROCLOR 1262	<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 02/25/87

RELEASED BY: A.M. Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER	SAMPLE ID :	AREA 4 SAMPLE 1	AREA 4 SAMPLE 2
	LAB ID :	87020824	87020825
	DATE RECEIVED:	02/24/87	02/24/87
BARIUM		18.9 ppm	7.17 ppm
CADMIUM		0.72 ppm	0.54 ppm
CHROMIUM		32.0 ppm	26.0 ppm
LEAD		304 ppm	168 ppm
CRESOL		<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL		<1.0 ppm	<1.0 ppm
AROCLOR 1016		<1 ppm	<1 ppm
AROCLOR 1221		<1 ppm	<1 ppm
AROCLOR 1232		<1 ppm	<1 ppm
AROCLOR 1242		<1 ppm	<1 ppm
AROCLOR 1248		<1 ppm	<1 ppm
AROCLOR 1254		<1 ppm	<1 ppm
AROCLOR 1260		<1 ppm	<1 ppm
AROCLOR 1262		<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION		YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 02/27/87

RELEASED BY: for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER				
SAMPLE ID :	AREA 4 ST-1+50 C-3-A 18"	AREA 4 ST-1+50 C-3-B 6"	AREA 4 ST-1+50 C-3-C 6"	AREA 4 ST-1+50 C-3-D 6"
LAB ID :	87020953	87020954	87020955	87020956
DATE RECEIVED:	02/25/87	02/25/87	02/25/87	02/25/87
BARIUM	23.3 ppm	13.9 ppm	14.5 ppm	23.9 ppm
CADMIUM	1.18 ppm	0.44 ppm	0.21 ppm	3.35 ppm
CHROMIUM	18.8 ppm	19.1 ppm	<1.00 ppm	21.4 ppm
LEAD	49.6 ppm	134 ppm	159 ppm	537 ppm
ACID DIGESTION	YES	YES	YES	YES
CRESOL	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
AROCLOR 1016	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1221	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1232	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1242	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1248	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1254	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1260	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1262	<1 ppm	<1 ppm	<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION	YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106
DATE: 02/27/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A. M. Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER				
SAMPLE ID :	AREA 4 ST-1+50 C-3-E 6"	AREA 4 ST-1+00 B-2-A 18"	AREA 4 ST-1+00 B-2-B 6"	AREA 4 ST-1+00 B-2-C 6"
LAB ID :	87020957	87020958	87020959	87020960
DATE RECEIVED:	02/25/87	02/25/87	02/25/87	02/25/87
BARIUM	8.46 ppm	49.4 ppm	15.4 ppm	64.9 ppm
CADMIUM	0.35 ppm	1.07 ppm	0.74 ppm	0.87 ppm
CHROMIUM	17.3 ppm	24.5 ppm	24.7 ppm	27.7 ppm
LEAD	128 ppm	374 ppm	123 ppm	172 ppm
ACID DIGESTION	YES	YES	YES	YES
CRESOL	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
AROCLOR 1016	<1 ppm	< 1 ppm	<1 ppm	<1 ppm
AROCLOR 1221	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1232	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1242	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1248	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1254	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1260	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1262	<1 ppm	<1 ppm	<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION	YES	YES	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 02/27/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A.M.Craw
for GEORGE E. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER				
SAMPLE ID :	AREA 4 ST-1+00 B-2-D 6"	AREA 4 ST-1+00 B-2-E 6"	AREA 5 ST-2+40 51' WEST	AREA 5 ST-2+00 55' WEST
LAB ID :	87020961	87020962	87020963	87020964
DATE RECEIVED:	02/25/87	02/25/87	02/25/87	02/25/87
BARIUM	95.4 ppm	61.4 ppm	25.8 ppm	27.6 ppm
CADMIUM	1.33 ppm	0.38 ppm	0.89 ppm	1.60 ppm
CHROMIUM	5.45 ppm	9.36 ppm	87.4 ppm	25.2 ppm
LEAD	198 ppm	65.6 ppm	130 ppm	93.6 ppm
ACID DIGESTION	YES	YES	YES	YES
CRESOL	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm	<1.0 ppm	<1.0 ppm	<1.0 ppm
AROCLOR 1016	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1221	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1232	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1242	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1248	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1254	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1260	<1 ppm	<1 ppm	<1 ppm	<1 ppm
AROCLOR 1262	<1 ppm	<1 ppm	<1 ppm	<1 ppm
EXTRACTION & CONCENTRATION	YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 02/27/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: G.M. Greene
for GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER	SAMPLE ID : AREA 4 ST-2+50 25' WEST LAB ID : 87020965 DATE RECEIVED: 02/25/87
BARIUM	38.1 ppm
CADMIUM	2.15 ppm
CHROMIUM	25.0 ppm
LEAD	149 ppm
ACID DIGESTION	YES
CRESOL	<1.0 ppm
PENTACHLOROPHENOL	<1.0 ppm
AROCLOR 1016	<1 ppm
AROCLOR 1221	<1 ppm
AROCLOR 1232	<1 ppm
AROCLOR 1242	<1 ppm
AROCLOR 1248	<1 ppm
AROCLOR 1254	<1 ppm
AROCLOR 1260	<1 ppm
AROCLOR 1262	<1 ppm
EXTRACTION & CONCENTRATION	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 03/03/87

RELEASED BY: [signature]
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER	SAMPLE ID :	C-3 A	C-3 B	C-3 C	C-3 D
	LAB ID :	87030026	87030027	87030028	87030029
	DATE RECEIVED:	03/02/87	03/02/87	03/02/87	03/02/87
CADMIUM		0.71 ppm	0.20 ppm	0.89 ppm	<0.20 ppm
LEAD		199 ppm	648 ppm	215 ppm	112 ppm
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/03/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER		C-3 E	C-3 F	C-3 G	SITE 250 A
	SAMPLE ID :	C-3 E	C-3 F	C-3 G	SITE 250 A
	LAB ID :	87030030	87030031	87030032	87030033
PARAMETER	DATE RECEIVED:	03/02/87	03/02/87	03/02/87	03/02/87
CADMIUM					1.30 ppm
LEAD		686 ppm	103 ppm	76.2 ppm	126 ppm
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/03/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: G.M. Greene
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER	SAMPLE ID :	SITE 250 B	SITE 250 C	SITE 250 D	SITE 250 E
	LAB ID :	87030034	87030035	87030036	87030037
	DATE RECEIVED:	03/02/87	03/02/87	03/02/87	03/02/87
CADMIUM		1.18 ppm	3.70 ppm	1.32 ppm	<0.20 ppm
LEAD		61.0 ppm	254 ppm	66.4 ppm	<1.00 ppm
ACID DIGESTION		YES	YES	YES	YES

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OMAHA , NE 68106

DATE: 03/03/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: G.M. Greene
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC1

PARAMETER	SAMPLE ID :	ST. 200 A	ST. 200 B	ST. 200 C	ST. 200 D
	LAB ID :	87030038	87030039	87030040	87030041
	DATE RECEIVED:	03/02/87	03/02/87	03/02/87	03/02/87
CADMIUM		0.38 ppm	1.11 ppm	2.28 ppm	0.35 ppm
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/03/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A.M. Crane
fr: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER	SAMPLE ID :	ST. 200 E	ST. 240 A	ST. 240 B	ST. 240 C
	LAB ID :	87030042	87030043	87030044	87030045
	DATE RECEIVED:	03/02/87	03/02/87	03/02/87	03/02/87
CADMIUM		0.96 ppm			
CHROMIUM			26.5 ppm	27.4 ppm	13.4 ppm
ACID DIGESTION		YES	YES	YES	YES

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Charleston, S.C. 29417
Phone (803) 556-8171

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Chemical Analysis

Laboratory Certification Number 10120

CLIENT: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

DATE: 04/09/86

CONTACT: MR. J. SPEAKMAN, PhD, PE

RELEASED BY:
GEORGE C. GREENE PE,PHD

CLIENT CODE: ENSA

PARAMETER			
	SAMPLE ID :	PCB1	PCB2
	LAB ID :	86030869	86030870
	DATE RECEIVED:	03/28/86	03/28/86
AROCLOR 1016		<0.5 ppm	<0.5 ppm
AROCLOR 1221		<0.5 ppm	<0.5 ppm
AROCLOR 1232		<0.5 ppm	<0.5 ppm
AROCLOR 1242		<0.5 ppm	<0.5 ppm
AROCLOR 1248		<0.5 ppm	<0.5 ppm
AROCLOR 1254		<0.5 ppm	<0.5 ppm
AROCLOR 1260		<0.5 ppm	<0.5 ppm
AROCLOR 1262		<0.5 ppm	<0.5 ppm

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Laboratory Certification Number 10120

CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/03/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: G.M. Greene
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER		
SAMPLE ID :	ST. 240 D	ST. 240 E
LAB ID :	87030046	87030047
DATE RECEIVED:	03/02/87	03/02/87
CHROMIUM	22.2 ppm	12.6 ppm
ACID DIGESTION	YES	YES

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Laboratory Certification Number 10120

CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/04/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: [signature]
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER	SAMPLE ID :	B-2 A	B-2 B	B-2 C	B-2 D
	LAB ID :	87030048	87030049	87030050	87030051
	DATE RECEIVED:	03/03/87	03/03/87	03/03/87	03/03/87
BARIUM		13.2 ppm	43.0 ppm		
CADMIUM		0.38 ppm	2.96 ppm		
CHROMIUM		3.58 ppm	10.6 ppm		
LEAD		85.8 ppm	119 ppm	120 ppm	120 ppm
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/04/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A.M. Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER				
	SAMPLE ID :	B-2 E	B-2 F	B-2 G
	LAB ID :	87030052	87030053	87030054
PARAMETER	DATE RECEIVED:	03/03/87	03/03/87	03/03/87
LEAD		16.9 ppm	19.0 ppm	73.1 ppm
ACID DIGESTION		YES	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/05/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: [signature]
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

PARAMETER		B-2 A	B-2 B	B-2 C	B-2 D
	SAMPLE ID :	B-2 A 03/04/87	B-2 B 03/04/87	B-2 C 03/04/87	B-2 D 03/04/87
	LAB ID :	87030156	87030157	87030158	87030159
	DATE RECEIVED:	03/04/87	03/04/87	03/04/87	03/04/87
CADMIUM		1.20 ppm	0.36 ppm	0.38 ppm	0.20 ppm
ACID DIGESTION		YES	YES	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/05/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: G.M. Greene
fn: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

PARAMETER					
	SAMPLE ID :	B-2 E 03/04/87	ST. 200 A 03/04/87	ST. 200 B 03/04/87	ST. 200 C 03/04/87
	LAB ID :	87030160	87030161	87030162	87030163
	DATE RECEIVED:	03/04/87	03/04/87	03/04/87	03/04/87
CADMIUM		0.98 ppm	2.00 ppm	1.37 ppm	1.11 ppm
ACID DIGESTION		YES	YES	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 03/05/87
RELEASED BY: A M Crane
fn: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

PARAMETER	
SAMPLE ID :	ST. 200 E 03/04/87
LAB ID :	87030164
DATE RECEIVED:	03/04/87
CADMIUM	0.34 ppm
ACID DIGESTION	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 03/05/87

RELEASED BY: G.M. Greene
fn: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER		ST. 240 A	ST. 240 B	ST. 240 C	ST. 240 D
	SAMPLE ID :	ST. 240 A 03/04/87	ST. 240 B 03/04/87	ST. 240 C 03/04/87	ST. 240 D 03/04/87
	LAB ID :	87030165	87030166	87030167	87030168
	DATE RECEIVED:	03/04/87	03/04/87	03/04/87	03/04/87
CHROMIUM		6.08 ppm	<1.00 ppm	2.67 ppm	20.9 ppm
ACID DIGESTION		YES	YES	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/05/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A.M. Crane
fr: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER		ST. 250 A	ST. 250 B	ST. 250 C	ST. 250 D
	SAMPLE ID :	ST. 250 A 03/04/87	ST. 250 B 03/04/87	ST. 250 C 03/04/87	ST. 250 D 03/04/87
	LAB ID :	87030169	87030170	87030171	87030172
	DATE RECEIVED:	03/04/87	03/04/87	03/04/87	03/04/87
CADMIUM		0.94 ppm	0.96 ppm	1.37 ppm	0.98 ppm
LEAD				37.8 ppm	48.4 ppm
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/05/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A M Greene
fn: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

PARAMETER	SAMPLE ID : ST. 250 E 03/04/87 LAB ID : 87030173 DATE RECEIVED: 03/04/87
CADMIUM	1.18 ppm
ACID DIGESTION	YES

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1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 03/05/87
RELEASED BY: A.M. Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

	SAMPLE ID :	C-3 A 03/04/87	C-3 B 03/04/87	C-3 C 03/04/87	C-3 D 03/04/87
	LAB ID :	87030174	87030175	87030176	87030177
PARAMETER	DATE RECEIVED:	03/04/87	03/04/87	03/04/87	03/04/87
LEAD		278 ppm	33.9 ppm	80.4 ppm	295 ppm
ACID DIGESTION		YES	YES	YES	YES

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CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 03/06/87
RELEASED BY: G.M. Greene
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

PARAMETER					
	SAMPLE ID :	C-3 A 30" 15'W 5'N	C-3 B 30" 20'W	C-3 C 30" 15'W 5'S	C-3 D 30" 15'S 5'W
	LAB ID :	87030240	87030241	87030242	87030243
	DATE RECEIVED:	03/06/87	03/06/87	03/06/87	03/06/87
LEAD		38.2 ppm	27.6 ppm	44.3 ppm	72.4 ppm
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/06/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: A.M. Crane
for GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

PARAMETER					
	SAMPLE ID :	C-3 E 30" 15'S 5'E	C-3 F 30" 20'S 5'E	ST. 250 A 25'W 15'SE 30"	ST. 250 B 25'W 5'W OF A 30"
	LAB ID :	87030244	87030245	87030246	87030247
	DATE RECEIVED:	03/06/87	03/06/87	03/06/87	03/06/87
CADMIUM				0.53 ppm	1.00 ppm
LEAD		34.2 ppm	28.7 ppm		
ACID DIGESTION		YES	YES	YES	YES

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1824 SO. 20th STREET
OMAHA , NE 68106
CONTACT: MR. LANNY L. LEVELL

DATE: 03/06/87
RELEASED BY: A.M. Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC3

PARAMETER		ST. 250 C	ST. 250 D	ST. 250 E	ST. 250 F
	SAMPLE ID :	ST. 250 C 25'W 5'N 30"	ST. 250 D 56'E 10'N 18"	ST. 250 E 61'E 5'N 18"	ST. 250 F 56'E 30"
	LAB ID :	87030248	87030249	87030250	87030251
	DATE RECEIVED:	03/06/87	03/06/87	03/06/87	03/06/87
CADMIUM		0.78 ppm	1.07 ppm	1.18 ppm	3.33 ppm
ACID DIGESTION		YES	YES	YES	YES

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Chemical Analysis

Laboratory Certification Number 10120

CLIENT: ANDERSON EXCAVATING & WRECKING CO.
1824 SO. 20th STREET
OMAHA , NE 68106

DATE: 03/10/87

CONTACT: MR. LANNY L. LEVELL

RELEASED BY: G.M. Crane
fr: GEORGE C. GREENE PE,PHD

CC/FC: AEWC/AEWC2

	SAMPLE ID :	ST. 200 A 03/09/87	ST. 200 B 03/09/87
	LAB ID :	87030289	87030290
PARAMETER	DATE RECEIVED:	03/09/87	03/09/87
CADMIUM		0.59 ppm	<0.20 ppm
ACID DIGESTION		YES	YES

Prior to Final Closure

Analytical Data - October 2, 1987

Source: EnSafe files.

[illegible]

	METHOD DETECTION LIMIT (ppm)
[illegible]IDINE	1.0
HYDRAZINE	2.5
PENTACHLOROPHENOL	1.0
FORMALDEHYDE	1.0
PYRIDINE	1.0
CRESOL (TOTAL)	1.0

	METHOD DETECTION LIMIT (ppb)
METHYLENE CHLORIDE	5.0
CHLOROFORM	5.0
1,1,1-TRICHLOROETHANE	5.0
CARBON TETRACHLORIDE	5.0
1,2-DICHLOROETHANE	5.0
TRICHLOROETHYLENE	5.0
TETRACHLOROETHYLENE	5.0
TOLUENE	5.0
DICHLOROFLUOROMETHANE	5.0
TRICHLOROFLUOROMETHANE	5.0
DIETHYL ETHER	5.0
METHYL ETHYL KETONE	5.0
METHYL ISOBUTYL KETONE	5.0
ETHYLENE OXIDE	5.0

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER 0062 - OLD CORRAL
SOIL SAMPLES

SAMPLE ID SAMPLE DATE	AA-6 10/05/97	AA-5 10/05/97	AA-4 10/05/97	AA-3 10/05/97	AA-2 10/05/97	AA-1 10/05/97	Z-1 10/02/97	Z-2 10/02/97	Z-3 [illegible]
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	15.4	39.3	44.0	40.0	BDL	BDL	BDL	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER 0050 - OLD CORRAL
SOIL SAMPLES

SAMPLE ID	I-4	I-5	I-6	I-7	Y-7	Y-8	Y-6	Y-5	Y-4
SAMPLE DATE	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87
(as received ppb)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	BDL	BDL	BDL	BDL	BDL	BDL	15.5	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible]62 - OLD CORRAL
SOIL SAMPLES

SAMPLE ID	Y-3	Y-2	Y-1	X-8	X-7	X-6	X-5	X-4	W-[illegible]
SAMPLE DATE	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	BDL	6.4	BDL	8.4	21.6	16.5	BDL	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER [illegible] - OLD CORRAL
SOIL SAMPLES

SAMPLE ID	W-8	W-7	W-6	W-5	W-4	V-5	V-6	V-7	U-6
SAMPLE DATE	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87	10/02/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	BDL	BDL	BDL	BDL	BDL	BDL	16.3	26.5	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER 0030 - OLD CORRAL
SOIL SAMPLES

SAMPLE ID	SP-13	SP-14	SP-15	SP-16	SP-17	SP-18	SP-19	SP-20	SP-21
SAMPLE DATE	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87
(as received ppm)									
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)									
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DICHLORODFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
DIETHYL ETHER	6.0	BDL	BDL	15.0	BDL	BDL	14.6	42.9	7.6
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER NUMBER 0020 - OLD CORRAL
SOIL SAMPLES

SAMPLE ID	SP-22	SP-23	SP-24	SP-25	SP-26	SP-27
SAMPLE DATE	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87	10/08/87
(as received ppm)						
2-AMINOPYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL
HYDRAZINE	BDL	BDL	BDL	BDL	BDL	BDL
PENTACHLOROPHENOL	BDL	BDL	BDL	BDL	BDL	BDL
FORMALDEHYDE	BDL	BDL	BDL	BDL	BDL	BDL
PYRIDINE	BDL	BDL	BDL	BDL	BDL	BDL
CRESOL (TOTAL)	BDL	BDL	BDL	BDL	BDL	BDL
(as received ppb)						
METHYLENE CHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL
CHLOROFORM	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-TRICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL
CARBON TETRACHLORIDE	BDL	BDL	BDL	BDL	BDL	BDL
1,2-DICHLOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL
TETRACHLOROETHYLENE	BDL	BDL	BDL	BDL	BDL	BDL
TOLUENE	BDL	BDL	BDL	BDL	BDL	BDL
DICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROETHANE	BDL	BDL	BDL	BDL	BDL	BDL
TRICHLOROFLUOROMETHANE	BDL	BDL	BDL	BDL	BDL	BDL
DIETHTL ETHER	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ETHYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL
METHYL ISOBUTYL KETONE	BDL	BDL	BDL	BDL	BDL	BDL
ETHYLENE OXIDE	BDL	BDL	BDL	BDL	BDL	BDL

BDL - BELOW DETECTION

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER 0082
DUPLICATE RESULTS SUMMARY

	Z-1			Y-8'			W-9'			AA-2			SP-13		
	1ST	2ND	% DUP	1ST	2ND	% DUP	1ST	2ND	% DUP	1ST	2ND	% DUP	1ST	2ND	% DUP
(as received ppm)															
2-AMINOPYRIDINE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
HYDRAZINE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
PENTACHLOROPHENOL	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
FORMALDEHYDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
PYRIDINE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
CRESOL (TOTAL)	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
(as received ppb)															
METHYLENE CHLORIDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
CHLOROFORM	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
1,1,1-TRICHLOROETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
CARBON TETRACHLORIDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
1,2-DICHLOROETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TRICHLOROETHYLENE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TETRACHLOROETHYLENE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TOLUENE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
DICHLORODFLUOROMETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TRICHLOROFLUOROETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
TRICHLOROFLUOROMETHANE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
DIETHYL ETHER	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	42.0	40.0	95	9.3	6.0	65
METHYL ETHYL KETONE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
METHYL ISOBUTYL KETONE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100
ETHYLENE OXIDE	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100	BDL	BDL	100

1ST - ORIGINAL SAMPLE
2ND - DUPLICATE
%DUP - % DUPLICATION
BDL - BELOW DETECTION LIMIT

SOUTHERN DIVISION NAVAL FACILITY
DELIVERY ORDER 008[illegible]
MATRIX SPIKE RESULTS

	Z-1					[illegible]-B'					W-9'				
	SAMPLE RESULT	SPK	EXP	FND	% REC	SAMPLE RESULT	SPK	EXP	FND	% REC	SAMPLE RESULT	SPK	EXP	FND	% REC
(as received ppm)															
HYDRAZINE	BDL	67.4	67.4	25.7	38	BDL	67.4	67.4	21.1	31	BDL	67.4	67.4	41.2	64
PYRIDINE	BDL	72.4	72.4	36.2	50	BDL	72.4	72.4	29.6	41	BDL	72.4	72.4	43.1	60
O-CRESOL	BDL	35.2	35.2	52.2	148	BDL	35.2	35.2	30.1	86	BDL	35.2	35.2	37.6	107
(as received ppb)															
METHYLENE CHLORIDE	BDL	9.9	9.9	4.0	40	BDL	9.9	9.9	4.1	42	BDL	9.9	9.9	4.1	42
CHLOROFORM	BDL	11.2	11.2	5.2	44	BDL	11.2	11.2	4.0	36	BDL	11.2	11.2	4.0	36
1,1,1-TRICHLOROETHANE	BDL	10.0	10.0	3.0	30	BDL	10.0	10.0	2.6	26	BDL	10.0	10.0	1.6	16
CARBON TETRACHLORIDE	BDL	12.0	12.0	3.0	25	BDL	12.0	12.0	1.6	20	BDL	12.0	12.0	1.6	13
1,2-DICHLOROETHANE	BDL	9.2	9.2	5.7	62	BDL	9.2	9.2	5.8	63	BDL	9.2	9.2	5.8	63
TRICHLOROETHYLENE	BDL	11.0	11.0	3.2	29	BDL	11.0	11.0	3.2	29	BDL	11.0	11.0	3.5	32
TETRACHLOROETHYLENE	BDL	12.2	12.2	4.4	36	BDL	12.2	12.2	3.6	30	BDL	12.2	12.2	3.6	30
TOLUENE	BDL	12.9	12.9	5.0	39	BDL	12.9	12.9	5.7	44	BDL	12.9	12.9	5.7	44
DIETHYL ETHER	BDL	142	142	123	87	BDL	35.5	35.5	33.9	95	BDL	141	141	102	72
METHYL ETHYL KETONE	BDL	160	160	128	80	BDL	40.0	40.0	33.5	84	BDL	160	160	137	86
METHYL ISOBUTYL KETONE	BDL	160	160	114	72	BDL	40.0	40.0	33.5	84	BDL	160	160	95	59

	AA-2					SP-13				
	SAMPLE RESULT	SPK	EXP	FND	% REC	SAMPLE RESULT	SPK	EXP	FND	% REC
(as received ppm)										
HYDRAZINE	BDL	67.5	67.5	54.6	42	BDL	67.5	67.5	20.4	27
PYRIDINE	BDL	72.4	72.4	28.6	40	BDL	72.4	72.4	18.5	26
O-CRESOL	BDL	35.2	35.2	21.6	52	BDL	35.2	35.2	18.3	61
(as received ppb)										
METHYLENE CHLORIDE	BDL	9.9	9.9	4.5	45	BDL	6.6	6.6	4.3	65
CHLOROFORM	BDL	11.2	11.2	5.5	49	BDL	7.5	7.5	5.3	71
1,1,1-TRICHLOROETHANE	BDL	10.0	10.0	4.0	40	BDL	6.7	6.7	4.6	69
CARBON TETRACHLORIDE	BDL	12.0	12.0	4.0	33	BDL	8.0	8.0	4.2	53
1,2-DICHLOROETHANE	BDL	9.2	9.2	6.5	71	BDL	6.3	6.3	6.0	95
TRICHLOROETHYLENE	BDL	11.0	11.0	3.5	32	BDL	6.7	6.7	4.2	63
TETRACHLOROETHYLENE	BDL	12.2	12.2	4.0	33	BDL	8.1	8.1	4.0	49
TOLUENE	BDL	12.9	12.9	7.0	54	BDL	8.6	8.6	4.6	53
DIETHYL ETHER	42.0	141	182	108	59	7.2	141	148	102	69
METHYL ETHYL KETONE	BDL	160	160	145	91	BDL	160	160	103	64
METHYL ISOBUTYL KETONE	BDL	160	160	125	78	BDL	160	160	145	91

SPK - SPIKE
EXP - EXPECTED
FND - FOUND
% REC - % RECOVERY
BDL - BELOW DETECTION LIMIT

Surface to Six Inch Soil Samples

Source: EnSafe files.

TABLE 3

EVALUATION OF SOIL CONTAMINATION
PUBLIC WORKS STORAGE YARD (OLD CORRAL)

	pH	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	NICKEL	SELENIUM	SILVER
THRESHOLD	6.5 4.3	51.29	2.00	1.25	26.51	146.92	1.00	10.11	0.20	1.00
SAMPLE										
AA-1	8.2 x	71.00 x	0.44	1.23	14.80	154.00 x	0.075	9.37	0.20	0.50
AA-2	7.9 x	17.70	0.30	0.10	6.07	12.10	0.020	2.33	0.20	0.50
AA-3	7.1 x	36.50	0.30	1.12	8.42	29.50	0.020	11.70 x	0.20	0.50
AA-4	7.1 x	25.60	0.30	0.87	10.40	45.20	0.114	8.26	0.20	0.50
AA-5	7.9 x	14.90	0.30	0.10	5.43	8.60	0.020	2.71	0.20	0.50
AA-6	5.1	15.60	0.30	0.10	5.03	8.23	0.020	3.66	0.20	0.50
Z-1	8.1 x	22.80	0.30	1.93 x	15.10	71.50	0.079	7.73	0.20	0.50
Z-2	8.5 x	44.90	0.30	2.17 x	28.00 x	105.00	0.134	15.90 x	0.20	0.50
Z-3	8.6 x	98.80 x	0.30	3.49 x	16.90	63.20	0.020	24.80 x	0.20	1.80 x
Z-4	9.0 x	64.50 x	0.30	5.06 x	12.60	68.90	0.020	36.20 x	0.20	2.62 x
Z-5	8.7 x	99.80 x	0.30	3.23 x	10.30	97.20	0.114	18.10 x	0.20	1.29 x
Z-6	8.3 x	48.70	0.30	4.19 x	17.30	114.00	0.065	67.50 x	0.20	2.41 x
Z-7	8.2 x	30.80	0.46	1.21	28.70 x	77.80	0.183	12.50 x	0.20	0.50
Y-1	8.3 x	45.20	0.30	1.31 x	28.20 x	92.40	0.079	11.70 x	0.20	0.50
Y-2	8.6 x	69.00 x	0.30	2.58 x	12.30	61.80	0.062	17.80 x	0.20	2.12 x
Y-3	8.9 x	92.20 x	0.30	2.58 x	12.40	79.30	0.046	21.80 x	0.20	1.49 x
Y-4	8.8 x	32.50	0.30	0.53	8.25	34.00	0.057	9.71	0.20	0.50
Y-5	10.3 x	51.60 x	0.30	2.56 x	11.90	110.00	2.910 x	14.60 x	0.20	0.50
Y-6	9.0 x	98.90 x	0.30	5.05 x	12.00	76.60	0.107	15.80 x	0.20	1.28 x
Y-7	8.5 x	118.00 x	0.30	4.39 x	11.50	67.40	0.020	30.30 x	0.20	2.56 x
Y-8	8.2 x	20.10	0.30	0.69	9.86	68.60	0.099	9.00	0.20	0.50
X-4	9.0 x	62.50 x	0.30	4.25 x	12.20	73.20	0.020	29.30 x	0.20	2.44 x
X-5	8.7 x	71.00 x	0.30	3.57 x	12.80	64.40	0.123	26.90 x	0.20	1.76 x
X-6	9.3 x	157.00 x	0.30	5.14 x	9.12	61.30	0.020	36.90 x	0.20	3.32 x
X-7	8.7 x	174.00 x	0.30	5.43 x	9.67	67.70	0.020	36.80 x	0.20	3.22 x
X-8	8.7 x	90.80 x	0.30	3.77 x	11.90	56.10	0.053	27.80 x	0.20	1.98 x

TABLE 3 (CONTINUED)

	pH	BARIUM	BERYLLIUM	CADMIUM	CHROMIUM	LEAD	MERCURY	NICKEL	SELENIUM	SILVER
THRESHOLD	6.5 4.3	51.29	2.00	1.25	26.51	146.92	1.00	10.11	0.20	1.00
SAMPLE										
W-4	8.3 x	46.90	0.40	1.35 x	39.40 x	178.00 x	0.151	12.50 x	0.20	0.50
W-5	9.5 x	144.00 x	0.30	4.83 x	8.93	61.00	0.020	33.80 x	0.20	2.97 x
W-6	8.6 x	119.00 x	0.30	3.74 x	11.80	62.90	0.067	32.70 x	0.20	2.37 x
W-7	8.4 x	75.40 x	0.30	3.33 x	5.96	32.80	0.020	22.30 x	0.20	1.49 x
W-8	9.1 x	169.00 x	0.30	4.66 x	9.24	53.50	0.021	34.70 x	0.20	2.69 x
W-9	8.5 x	60.10 x	0.44	2.19 x	15.10	68.40	0.082	15.60 x	0.20	0.50
V-5	8.6 x	116.00 x	0.30	2.67 x	16.00	90.40	0.134	22.80 x	0.20	0.97
V-6	8.3 x	86.40 x	0.30	9.38 x	20.60	160.00 x	0.734	35.40 x	0.20	0.82
V-7	8.9 x	44.80	0.30	1.48 x	16.60	85.90	0.154	16.60 x	0.20	0.50
U-6	8.9 x	49.30	0.30	2.68 x	12.20	44.60	0.044	9.47	0.20	0.50
SP-13	8.2 x	44.50	0.30	3.90 x	13.80	194.00 x	0.020	29.80 x	0.20	2.29 x
SP-14	8.3 x	33.90	0.30	2.99 x	12.00	982.00 x	0.020	22.40 x	0.20	1.50 x
SP-15	8.1 x	31.80	0.30	1.82 x	18.20	90.40	0.054	13.60 x	0.20	0.91
SP-16	8.8 x	42.80	0.30	4.52 x	9.62	64.90	0.020	35.10 x	0.20	8.66 x
SP-17	8.2 x	42.30	0.30	5.27 x	9.45	62.10	0.028	38.80 x	0.20	3.48 x
SP-18	8.2 x	36.50	0.30	2.88 x	12.50	70.10	0.079	21.60 x	0.20	1.44 x
SP-19	9.0 x	81.20 x	0.30	1.34 x	55.70 x	399.00 x	0.105	19.20 x	0.20	0.50
SP-20	8.3 x	39.00	0.30	3.39 x	9.49	684.00 x	0.029	25.00 x	0.20	2.50 x
SP-21	8.3 x	58.40 x	0.30	6.78 x	9.82	59.40	0.051	36.80 x	0.20	2.95 x
SP-22	8.5 x	36.80	0.30	1.52 x	8.75	66.30	0.104	8.29	0.20	0.50
SP-23	8.4 x	39.40	0.30	2.36 x	18.80	54.40	0.090	12.00 x	0.20	0.50
SP-24	8.3 x	66.20 x	0.30	4.82 x	8.27	61.10	0.020	34.00 x	0.20	2.68 x
SP-25	9.4 x	45.80	0.30	3.51 x	9.35	57.00	0.028	34.10 x	0.20	2.34 x
SP-26	8.2 x	29.70	0.30	2.19 x	22.40	108.00	0.201	16.10 x	0.20	0.97
SP-27	8.1 x	30.60	0.30	0.48	11.00	45.00	0.226	3.78	0.20	0.50

Supplemental Samples Collected at

1-, 2-, and 3-foot Intervals

SOUTHERN DIVISION NAVAL FACILITIES

DELIVERY ORDER # 0096

OLD CORRAL SOIL SAMPLES

CHARLESTON, SC NAVAL SHIPYARD

ETC #	Sample I.D.	Date	Results (as received ppm)							
			pH	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Silver
1	W8-1	3/21	7.7	18.7	<0.1	-	-	-	<1.0	<0.5
2	W8-2	3/21	8.0	27.8	<0.1	-	-	-	6.73	1.34
3	W8-3	3/21	8.4	25.0	<0.1	-	-	-	10.6	<0.5
4	W9-1	3/21	8.0	36.1	<0.1	-	-	-	11.3	-
5	W9-2	3/21	7.9	23.9	<0.1	-	-	-	7.51	-
6	W9-3	3/21	8.2	22.9	<0.1	-	-	-	8.71	-
7	W7-1	3/21	8.2	29.4	<0.1	-	-	-	8.90	<0.5
8	W7-2	3/21	7.7	25.5	<0.1	-	-	-	10.6	<0.5
9	W7-3	3/21	8.2	19.2	<0.1	-	-	-	10.2	<0.5
10	W6-1	3/21	8.1	27.3	<0.1	-	-	-	13.1	0.64
11	W6-2	3/21	8.2	17.5	<0.1	-	-	-	7.97	<0.5
12	W6-3	3/21	8.5	19.0	<0.1	-	-	-	8.85	<0.5
13	W5-1	3/21	9.4	46.1	<0.1	-	-	-	8.20	1.17
14	W4-1	3/21	7.4	-	<0.1	4.46	12.4	-	2.23	-
15	W4-2	3/21	7.4	-	<0.1	2.86	12.9	-	1.19	-
16	V6-1	3/21	8.4	13.8	<0.1	-	34.3	-	2.32	-
17	V6-2	3/21	8.4	21.4	<0.1	-	32.4	-	10.6	-
18	V6-3	3/21	8.4	16.8	<0.1	-	23.1	-	7.33	-
19	V7-1	3/21	8.7	-	<0.1	-	-	-	1.96	-
20	U6-1	3/21	7.7	-	<0.1	-	-	-	-	-
21	U6-2	3/21	7.7	-	<0.1	-	-	-	-	-
22	U6-3	3/21	8.2	-	<0.1	-	-	-	-	-
23	V5-1	3/21	8.1	21.1	<0.1	-	-	-	5.64	-
24	X4-1	3/21	8.3	20.1	<0.1	-	-	-	3.50	<0.5
25	X4-2	3/21	8.8	24.6	<0.1	-	-	-	4.43	<0.5
26	X5-1	3/21	7.3	30.7	<0.1	-	-	-	14.3	<0.5
27	X5-2	3/21	7.4	22.5	<0.1	-	-	-	10.2	<0.5
28	X5-3	3/21	8.5	21.7	<0.1	-	-	-	10.7	<0.5
29	X6-1	3/21	7.5	26.2	<0.1	-	-	-	11.3	<0.5
30	X6-2	3/21	7.7	20.5	<0.1	-	-	-	11.0	<0.5
31	X6-3	3/21	8.5	23.8	<0.1	-	-	-	10.9	<0.5
32	X7-1	3/21	7.8	22.0	<0.1	-	-	-	7.65	<0.5
33	X7-2	3/21	8.1	23.6	<0.1	-	-	-	11.1	<0.5
34	X7-3	3/21	8.1	18.4	<0.1	-	-	-	8.72	<0.5
35	X8-1	3/21	7.2	23.3	<0.1	-	-	-	8.82	<0.5
36	X8-2	3/21	8.0	20.2	<0.1	-	-	-	9.48	<0.5
37	X8-3	3/21	8.3	31.1	<0.1	-	-	-	12.0	<0.5
38	Y8-1	3/21	7.6	-	-	-	-	-	-	-
39	Y8-2	3/21	7.4	-	-	-	-	-	-	-
40	Y8-3	3/21	7.6	-	-	-	-	-	-	-

SOUTHERN DIVISION NAVAL FACILITIES

DELIVERY ORDER # 0096

OLD CORRAL SOIL SAMPLES

CHARLESTON, SC NAVAL SHIPYARD

ETC #	Sample I.D.	Date	Results (as received ppm) pH	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Silver
85	SP13-1	3/23	8.0	-	<0.1	-	22.9	-	13.7	<0.5
86	SP15-1	3/23	5.5	-	<0.1	-	-	-	3.13	-
87	SP16-1	3/23	6.7	-	<0.1	-	-	-	2.71	<0.5
88	SP17-1	3/23	7.6	-	<0.1	-	-	-	1.96	<0.5
89	SP17-2	3/23	6.0	-	<0.1	-	-	-	2.79	<0.5
90	SP17-3	3/23	7.9	-	<0.1	-	-	-	4.82	<0.5
91	SP18-1	3/23	7.3	-	<0.1	-	-	-	3.94	<0.5
92	SP18-2	3/23	7.4	-	<0.1	-	-	-	2.54	<0.5
93	SP18-3	3/23	8.4	-	<0.1	-	-	-	12.0	<0.5
94	SP19-1	3/23	7.7	22.7	1.19	9.40	11.3	-	2.21	-
95	SP19-2	3/23	8.1	42.1	2.33	13.4	271	-	66.9	-
96	SP19-3	3/23	8.1	21.4	<0.1	22.4	20.9	-	10.5	-
97	SP20-1	3/23	6.5	-	<0.1	-	7.66	-	1.21	<0.5
98	SP20-2	3/23	8.0	-	<0.1	-	41.2	-	9.67	<0.5
99	SP20-3	3/23	8.2	-	<0.1	-	20.9	-	7.62	<0.5
00	SP21-1	3/23	8.1	32.0	<0.1	-	-	-	6.69	<0.5
101	SP21-2	3/23	8.3	32.8	<0.1	-	-	-	10.5	<0.5
102	SP21-3	3/23	8.3	25.1	<0.1	-	-	-	5.94	<0.5
103	SP22-1	3/23	9.2	-	<0.1	-	-	-	-	-
104	SP23-1	3/23	8.2	-	<0.1	-	-	-	3.49	-
105	SP24-1	3/23	7.1	35.5	<0.1	-	-	-	11.4	<0.5
106	SP24-2	3/23	7.6	19.4	<0.1	-	-	-	8.62	<0.5
107	SP24-3	3/23	8.2	26.5	2.47	-	-	-	10.3	<0.5
108	SP25-1	3/23	8.2	-	<0.1	-	-	-	8.04	<0.5
109	SP25-2	3/23	8.6	-	6.61	-	-	-	9.87	<0.5
110	SP25-3	3/23	8.8	-	11.5	-	-	-	5.86	<0.5
111	SP26-1	3/23	7.3	-	11.1	-	-	-	12.3	-
112	SP26-2	3/23	7.1	-	<0.1	-	-	-	12.3	-
113	SP26-3	3/23	8.2	-	<0.1	-	-	-	7.72	-
114	SP27-1	3/23	8.3	-	-	-	-	-	-	-
115	SP27-2	3/23	8.3	-	-	-	-	-	-	-
116	SP27-3	3/23	8.1	-	-	-	-	-	-	-
117	Z1-1	3/23	8.7	-	11.1	-	-	-	-	-
118	Y1-1	3/24	8.1	-	<0.1	3.95	-	-	<1.0	-
119	BG1-2	3/24	8.8	-	-	-	-	-	-	-
120	BG2-2	3/24	5.4	-	-	-	-	-	-	-
121	BG3-2	3/24	5.0	-	-	-	-	-	-	-

Supplemental Sampling

Station W-5

Note: Three background samples were collected at depth 0-1 foot at locations near background sample locations from previous sampling events, specifically:

- * south of the golf course pro shop (at the end of Everglades Drive);
- * within the dredge spoil containment area northeast of the brigg (on Juneau Avenue); and
- * behind the missile monument at the intersection of Viaduct Road and Hobson Avenue (about 200 yards west of the old corral).

Source: EnSafe. February, 1991. Supplemental Smpling Old Corral Station W-5.

GENERAL ENGINEERING LABORATORIES

Environmental Engineering and Analytical Services

Molly F. Greene
President

George C. Greene, P.E., Ph.D.
Vice President
SC Registration No. [illegible]

Laboratory Certifications

FL	E87156/87294
NC	[illegible]
SC	10120
VA	00151
TN	[illegible]

CERTIFICATE OF ANALYSIS

Client: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

Date: 02/06/91

Contact: MR. J. SPEAKMAN, PhD, PE

Released by: [signature]
QA/QC Officer

cc/fc: ENSA/ENSAU Project Manager: Edie M. Kent Page No.: 1

	Sample ID :	W-5-1	W-5-2	W-5-3
	Lab ID :	91011918	91011919	91011920
	Sample Matrix :	SOLID	SOLID	SOLID
	Date Collected:	01/25/91	01/25/91	01/25/91
	Date Received :	01/25/91	01/25/91	01/25/91
	Priority :	Routine	Routine	Routine
Parameter	Collected by :	GEL	GEL	GEL
ACETONE		<100 ppb	<100 ppb	<100 ppb
XYLENE, TOTAL		<200 ppb	<200 ppb	<200 ppb
METHANOL		<1 ppm	<1 ppm	<1 ppm
PENTACHLOROPHENOL		<100 ppb	<100 ppb	<100 ppb
SAMPLE PREP - ACID COMPOUNDS		YES	YES	YES
EVAPORATIVE LOSS @ 105 C		10 wt%	13 wt%	40 wt%
CATION EXCHANGE CAPACITY		6.84 meq	6.24 meq	18.2 meq

P.O. Box 30712 • Charleston, SC 29417
Phone (803) 556-8171 • FAX (803) 766-1178

A&L Analytical Laboratories, Inc.

411 North Third Street • Memphis, TN 38105-2723 • (901) 527-2780 • FAX: (901) 526-1031

ACCT # 1388

REPORT NUMBER
036-005A

February 6, 1991

RECEIVED

Ensafe
5724 Summer Trees Dr.
P.O. Box 341315
Memphis, TN 38184-1315

LAB NUMBER:	SAMPLE ID:	CEC (meq/100g)	BASE SATURATION (%)
26602	W51	4.1	100
26603	W52	3.8	100
26604	W53	10.3	100
26605	BKA	4.3	100
26606	BKB	8.1	100
26607	BKC	10.8	100

NOTE: All samples had free carbonates.

A & L Analytical Laboratories, Inc.

Richard Large J.P.

Richard Large, PhD Managing Director

RL/dlh

A&L Analytical Laboratories, Inc.

411 North Third Street • Memphis, TN 38105-2723 • (901) 527-2780 • FAX: (901) 526-1031

Additional Results

REPORT NUMBER
036-004A

ACCT # 1388

February 12, 1991

RECEIVED
FEB 13

Ensafe
5724 Summer Trees Dr.
P.O. Box 341315
Memphis, TN 38184-1315
Attn: James Speakman

Project # 1073-040

LAB NUMBER:	SAMPLE ID:	K ppm	Mg ppm	Ca ppm	Na ppm	pH	% Free Carbonate
26602	W51	125	152	2150	350	7.7	7.77
26603	W52	125	131	2220	520	8.1	8.63
26604	W53	576	649	2660	2910	8.0	12.02
26605	BKA	74	128	1770	20	7.6	2.76
26606	BKB	53	76	2490	19	7.9	5.71
26607	BKC	30	87	2800	10	7.7	4.57

NOTE: Cations run by IN Ammonium Acetate at pH 7.0
pH is 1:1 soil water ratio
Free Carbonates ASA 91-5.1 (1965)

A & L Analytical Laboratories, Inc.

Richard Large

Richard Large, PhD   Managing Director

RL/dlh

APPENDIX G

PCB TRANSFORMER STORAGE AREA - ANALYTICAL DATA

(Source: Reference 12)

GENERAL ENGINEERING LABORATORIES

Full Service Chemical Testing and Analysis

Office & Lab.
1313 Ashley River Road
Charleston, S.C.
Phone (803) 556-8171

Mailing Address
P.O. Box 30712
Charleston, S.C. 2940[illegible]

Analysis Sheet

Client Geraghty & Miller, Inc. P.O. Box 271173 Tampa, Florida 33688	Date July 16, 1981 P.O. No. Requested by Mr. Peter Palmer

Sample Identification	Results

Analysis of Soil Samples for PCBs

Sample Identification	PCB Concentration
Sample A	<10 mg/kg
Sample B	<10 mg/kg
Sample C	<10 mg/kg
Sample D	<10 mg/kg
Sample E	<10 mg/kg
Sample F	<10 mg/kg

By George C. Greene
George C. Greene, PhD

ENERGY RESOURCES CO. INC

INORGANIC ANALYSIS

- Report Sheet -
μg/gm dry wgt.

Analyzed for: Geraghty & Miller
Sediments

ERCO ID	CLIENT ID	As
IC-82		
562	OC-1	6.7
563	OC-2	6.0
564	OC-3	15.5
565	OC-4	4.1
566	OC-5	2.1
567	OC-6	10.2
568	OC-7	7.3
569	OC-8	6.9

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID#.

Sample Rcvd. 2/17/82 Reported by Lar

Date Analysis Completed 3/16/82 Checked by

ENERGY RESOURCES CO. INC

INORGANIC ANALYSIS

- Report Sheet -
µg/gm dry wgt. - µg/l

Analyzed for: Geraghty & Miller
Sediments - waters

ERCO ID	CLIENT ID	As
IC-82-		
	Sediments	µg/gm
570	OC-9	3.9
570	ERCO DUPLICATE	3.3
571	OC-10	5.1
572	OC-11	2.8
573	OC-12	1.3
	Waters	µg/l
574	WOC-1	19
575	WOC-2	13

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID#.

Sample Rcvd. 2/17/82 Reported by Las

Date Analysis Completed 3/16/82 Checked by [illegible]

ENERGY RESOURCES CO. INC.
PESTICIDE ANALYSIS REPORT

Analyzed for: Geraghty & Miller   All results in: µg/l (ppb)

Client ID:	WOC-1	WOC-2
89P aldrin	ND	ND
90P dieldrin	ND	ND
91P chlordane	ND	ND
92P 4,4'-DDT	0.2	ND
93P 4,4'-DDE	ND	ND
94P 4,4'-DDD	ND	0.1
95P alpha-endosulfan	ND	ND
96P beta-endosulfan	ND	ND
97P endosulfan sulfate	ND	ND
98P endrin	ND	ND
99P endrin aldehyde	ND	ND
100P heptachlor	ND	ND
101P heptachlor epoxide	ND	ND
102P alpha-BHC	ND	1.0
103P beta-BHC	ND	ND
104P gamma-BHC	ND	1.0
105P delta-BHC	ND	1.0
106P PCB-1242	ND	ND
107P PCB-1254	ND	ND
108P PCB-1221	ND	ND
109P PCB-1232	ND	ND
110P PCB-1248	ND	ND
111P PCB-1260	0.2	0.6
112P PCB-1016	ND	ND
113P toxaphene	ND	ND

Sample Received: 2/17/82   Reported by: E Kwang
Date Completed: 3/25/82   Checked by: S. [illegible]
Comments: ND = not detected (less than 1. µg/l)

ENERGY RESOURCES CO. INC.
PESTICIDE ANALYSIS REPORT

Analyzed for: Geraghty & Miller   All results in: ng/gm (ppb)

Client ID:	OC-1	OC-2	OC-3	OC-4	OC-5
89P aldrin	ND	ND	ND	ND	ND
90P dieldrin	ND	ND	ND	ND	ND
91P chlordane	ND	ND	ND	ND	ND
92P 4,4'-DDT	28,000.	4,400.	1,600.	100.	7.
93P 4,4'-DDE	11,000.	3,600.	1,300.	230.	9.
94P 4,4'-DDD	6,100.	1,400.	720.	7.	1.
95P alpha-endosulfan	ND	ND	ND	ND	ND
96P beta-endosulfan	ND	ND	ND	ND	ND
97P endosulfan sulfate	ND	ND	ND	ND	ND
98P endrin	ND	ND	ND	ND	ND
99P endrin aldehyde	ND	ND	ND	ND	ND
100P heptachlor	7.	ND	1.	2.	1.
101P heptachlor epoxide	ND	ND	ND	ND	ND
102P alpha-BHC	60.	2.	2.	ND	ND
103P beta-BHC	120.	77.	ND	ND	ND
104P gamma-BHC	150.	ND	ND	ND	ND
105P delta-BHC	780.	4.	17.	1.	ND
106P PCB-1242	ND	ND	ND	ND	ND
107P PCB-1254	ND	ND	ND	ND	ND
108P PCB-1221	ND	ND	ND	ND	ND
109P PCB-1232	ND	ND	ND	ND	ND
110P PCB-1248	ND	ND	ND	ND	ND
111P PCB-1260	ND	62,000.	37,000.	675.	150.
112P PCB-1016	ND	ND	ND	ND	ND
113P toxaphene	ND	ND	ND	ND	ND

Sample Received: 2/17/82   Reported by: E. Kwong
Date Completed: 3/25/82   Checked by: S. D[illegible]
Comments: ND = not detected (less than ng/gm)

G-5

ENERGY RESOURCES CO. INC.
PESTICIDE ANALYSIS REPORT

Analyzed for: Geraghty & Miller   All results in: ng/gm (ppb)

Client ID:	OC-6	OC-7	OC-8	OC-9	OC-10
89P aldrin	ND	ND	ND	ND	ND
90P dieldrin	ND	ND	ND	ND	ND
91P chlordane	ND	ND	ND	ND	ND
92P 4,4'-DDT	1,100.	13,000.	3,200.	29.	11,000.
93P 4,4'-DDE	560.	3,300.	600.	18.	2,900.
94P 4,4'-DDD	94.	2,700.	1,400.	17.	2,600.
95P alpha-endosulfan	ND	ND	ND	ND	ND
96P beta-endosulfan	ND	ND	ND	ND	ND
97P endosulfan sulfate	ND	ND	ND	ND	ND
98P endrin	ND	ND	ND	ND	ND
99P endrin aldehyde	ND	ND	ND	ND	ND
100P heptachlor	1.	1.	ND	ND	10.
101P heptachlor epoxide	ND	ND	ND	ND	ND
102P alpha-BHC	ND	2.	1.	1.	5.
103P beta-BHC	ND	20.	14.	ND	45.
104P gamma-BHC	1.	44.	22.	ND	43.
105P delta-BHC	1.	150.	88.	1.	171.
106P PCB-1242	ND	ND	ND	ND	ND
107P PCB-1254	ND	ND	ND	ND	ND
108P PCB-1221	ND	ND	ND	ND	ND
109P PCB-1232	ND	ND	ND	ND	ND
110P PCB-1248	ND	ND	ND	ND	ND
111P PCB-1260	3,200.	3,000.	1,100.	170.	530.
112P PCB-1016	ND	ND	ND	ND	ND
113P toxaphene	ND	ND	ND	ND	ND

Sample Received: 2/17/82   Reported by: E. Kwong

Date Completed: 3/25/82   Checked by: [signature]

Comments: ND = not detected (less than 1. ng/gm)

ENERGY RESOURCES CO. INC.
PESTICIDE ANALYSIS REPORT

Analyzed for: Geraghty & Miller All results in: ng/gm (ppb)

Client ID:	OC-11	OC-12	Blank	OC-9*	OC-10*
89P aldrin	ND	ND	ND	ND	ND
90P dieldrin	ND	ND	ND	ND	ND
91P chlordane	ND	ND	ND	ND	ND
92P 4,4'-DDT	40,000.	1,200.	ND	48.	14,000.
93P 4,4'-DDE	8,200.	590.	ND	20.	3,100.
94P 4,4'-DDD	6,900.	380.	ND	23.	3,000.
95P alpha-endosulfan	ND	ND	ND	ND	ND
96P beta-endosulfan	ND	ND	ND	ND	ND
97P endosulfan sulfate	ND	ND	ND	ND	ND
98P endrin	ND	ND	ND	ND	ND
99P endrin aldehyde	ND	ND	ND	ND	ND
100P heptachlor	29.	ND	ND	ND	8.
101P heptachlor epoxide	ND	ND	ND	ND	ND
102P alpha-BHC	25.	1.	ND	1.	10.
103P beta-BHC	140.	2.	ND	ND	62.
104P gamma-BHC	150.	3.	ND	ND	64.
105P delta-BHC	660.	ND	ND	1.	240.
106P PCB-1242	ND	ND	ND	ND	ND
107P PCB-1254	ND	ND	ND	ND	ND
108P PCB-1221	ND	ND	ND	ND	ND
109P PCB-1232	ND	ND	ND	ND	ND
110P PCB-1248	ND	ND	ND	ND	ND
111P PCB-1260	11,000.	ND	ND	180.	510.
112P PCB-1016	ND	ND	ND	ND	ND
113P toxaphene	ND	ND	ND	ND	ND

Sample Received: 2/17/82 Reported by: E. Kwong

Date Completed: 3/25/82 Checked by: [signature]

Comments: ND = not detected (less than ng/gm)
*Duplicate

pH MEASUREMENTS OF WATER SAMPLES COLLECTED FROM MONITOR WELLS AT THE ELECTRICAL TRANSFORMER STORAGE AREA, FEBRUARY 12, 1982[1]

Well Number	pH
WOC-1	7.36
WOC-2	7.33

[1] Measured at the time of sample collection.

APPENDIX H

OIL SLUDGE PIT - ANALYTICAL DATA

(Source: Reference 12)

ENERGY RESOURCES CO. INC.

INORGANIC CHEMISTRY LABORATORY

- Report of Chemical Analyses -

Client: Geraghty & Miller
Charleston, S.C.

ERCO ID	Client ID	Cl Concentration (gm/l)
51-928	OP-1	6.0
51-929	OP-3	1.4

Sample Rcvd. 7/30/81
Date Completed 8/25/81
Date of this rpt. 5/4/82
Reported by Kah
Checked by

Sample Rcvd: 8/3/81

Date Analysis Completed: 8/26/81

All Results In:

Reported By: Kathy Hemmerle

Checked By: Kile

ENERGY RESOURCES CO. INC.

POLYCHLORINATED BIPHENYLS (PCB)

- Report Sheet -

Analyzed for: Geraghty Miller

	Detection Limit	51-928 OP-1 28-312	51-929 OP-3 28-313
Aroclor 1221		ND	ND
Aroclor 1232		ND	ND
Aroclor 1016		ND	ND
Aroclor 1242		ND	ND
Aroclor 1248		ND	ND
Aroclor 1254		ND	ND
Aroclor 1260		.04ppb	ND
Aroclor 1262		ND	ND

Comments:

pH MEASUREMENTS OF WATER SAMPLES
COLLECTED FROM MONITOR WELLS AT THE
OIL-SLUDGE PIT AREA,
JULY 29, 1981[1]

Well Number	pH
OPW-1	7.50
OPW-3	6.40

[1] Measured at the time of sample collection.

ENERGY RESOURCES CO. INC

TRACE METAL ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller
Charleston, S.C.

mg/l unless otherwise stated

ERCO ID	CLIENT ID	F	NO^3	SO_4	TOC	COND umhos/cm
51-928	OP-1	--	--	<1	--	--
51-929	OP-3	--	--	780	--	--

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID #.

Sample Rcvd. 7/30/81

Reported by

Date Analysis Completed 8/25/81

Checked by

Sample Rcvd: 7/30/81

Date Analysis Completed: 8/7/81

All Results In: mg/l

Reported By:

Checked By:

ENERGY RESOURCES CO. INC.

VOLATILE ORGANICS ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller

Compounds (in order of elution)	OP-1	OP-3
Vinyl chloride		
Methylene chloride	0.84	0.17
1,1-dichloroethylene		
1,1-dichloroethane		
trans-1,2-dichloroethylene		
1,2-dichloroethane		
1,1,1-trichloroethane		
1,2-Dichloropropane		
Trichloroethylene		
1,1,2-Trichloroethane		
Tetrachloroethylene		
Chlorobenzene		
Unknown	1.39	

Comments: All blank spaces are ND's (n e detected) (<0.05 mg/l, or 50 ppb)

APPENDIX I

CLOSED LANDFILL - ANALYTICAL DATA

(Source: Reference 9, 17)

ENERGY RESOURCES CO. INC

TRACE METAL ANALYSIS

\- Report Sheet -

Analyzed for: Geraghty & Miller
Charleston, S.C.

mg/l unless otherwise stated

ERCO ID	CLIENT ID	F.	NO^3	SO_4	TOC	COND umhos/cm
51-920	LF-1	0.34	<0.01	28	120	32,000
51-921	LF-2	0.16	0.10	15	120	6,400
51-922	LF-3	0.29	<0.01	<1	88	40,000
51-923	LF-4	0.56	<0.01	600	100	31,000
51-924	LF-5	0.53	<0.01	<1	150	36,000
51-925	SLF-1	0.52	<0.01	<1	63	6,500
51-926	SLF-2	0.25	<0.01	130	67	19,000
51-927	DLF-1	0.16	0.25	37	57	580

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID #.

Sample Rcvd. 7/30/81 Reported by *[signature]*

Date Analysis Completed 8/25/81 Checked by *[signature]*

ENERGY RESOURCES CO. INC

TRACE METAL ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller
Charleston, S.C.

ug/l unless otherwise stated

ERCO ID	CLIENT ID	Cd	Fe	Pb	Mg mg/l	Hg	Na mg/l
51-920	LP-1	<1	58	<5	760	0.4	6000
51-921	LP-2	<1	80	<5	110	<0.1	1200
51-922	LP-3	<1	600	<5	1020	<0.1	7200
51-923	LP-4	<1	4100	<5	560	<0.1	5100
51-924	LP-5	<1	310	<5	960	<0.1	6800
51-925	SLP-1	<1	1700	<5	140	<0.1	1000
51-926	SLP-2	<1	320	<5	140	<0.1	3000
51-927	DLP-1	<1	36	<5	1.6	<0.1	34

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID #.

Sample Rcvd. 7/30/81 Reported by *ml*

Date Analysis Completed 8/25/81 Checked by *fch*

ENERGY RESOURCES CO. INC

INORGANIC ANALYSIS

- Report Sheet -
μg/l

Analyzed for: Geraghty & Miller
Waters

ERCO ID	CLIENT ID	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
IC-82-									
578	LF-6	15	380	<2	<5	<5	<0.1	<20	<1
579	LF-7	<10	1300	<2	<5	<5	<0.1	<20	<1
580	LF-8	66	590	<2	<5	18	<0.1	<20	<1
581	LF-9	<10	380	<2	<5	22	<0.1	<20	<1
581	ERCO DUPLICATE	--	370	<2	<5	22	<0.1	<20	<1
582	LF-10	<10	4620	<2	<5	<5	<0.1	<20	<1
583	SLF-1	<10	--	--	<5	--	--	<20	<1
584	SLF-2	<10	--	--	<5	--	--	<20	<1
585	LF-1	70	--	--	8.2	--	--	<20	<1
586	LF-3	24	--	--	<5	--	--	<20	<1
587	LF-4	<10	--	--	<5	--	--	<20	<1

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID#.

Sample Rcvd. 2/17/82 Reported by Lee

Date Analysis Completed 3/16/82 Checked by [illegible]

ENERGY RESOURCES CO. INC.

INORGANIC CHEMISTRY LABORATORY

- Report of Chemical Analyses -

Client: Geraghty & Miller
Charleston, S.C.

ERCO ID	Client ID	Cl Concentration (gm/l)
51-920	LF-1	11.0
51-921	LF-2	1.6
51-922	LF-3	7.3
51-923	LF-4	7.2
51-924	LF-5	7.1
51-925	SLF-1	0.93
51-926	SLF-2	3.8
51-927	DLF-1	0.07

Sample Rcvd. 7/30/81

Date Completed 8/25/81

Date of this rpt. 5/4/82

Reported by Kale

Checked by

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller

IENT I.D. SLF-1 DATE SAMPLE RECEIVED 2/17/82

CO I.D. 13-1254 DATE ANALYSIS COMPLETED 3/1/82

	ACID COMPOUNDS	ug/l
A	2,4,6-trichlorophenol	ND
A	p-chloro-m-cresol	ND
A	2-chlorophenol	ND
A	2,4-dichlorophenol	ND
A	2,4-dimethylphenol	ND
A	2-nitrophenol	ND
A	4-nitrophenol	ND
A	2,4-dinitrophenol	ND
A	4,6-dinitro-o-cresol	ND
A	pentachlorophenol	ND
A	phenol	ND

	BASE/NEUTRAL COMPOUNDS	
	acenaphthene	ND
	benzidine	ND
	1,2,4-trichlorobenzene	ND
	hexachlorobenzene	ND
B	hexachloroethane	ND
B	bis(2-chloroethyl)ether	ND
B	2-chloronaphthalene	ND
B	1,2-dichlorobenzene	ND
B	1,3-dichlorobenzene	ND
B	1,4-dichlorobenzene	*
B	3,3-dichlorobenzidine	ND
	2,4-dinitrotoluene	ND
	2,6-dinitrotoluene	ND
	1,2-diphenylhydrazine	ND
	fluoranthene	ND
	4-chlorophenyl phenyl ether	ND

ND = Not detected
NA = Not applicable
* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	*
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	ND
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

Reported by: TM

Checked by: C. [illegible]

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller

IENT I.D. SLF-2 DATE SAMPLE RECEIVED 2/17/82

CO I.D. 13-1255 DATE ANALYSIS COMPLETED 3/1/82

	ACID COMPOUNDS	ug/l
A	2,4,6-trichlorophenol	ND
A	p-chloro-m-cresol	ND
A	2-chlorophenol	ND
A	2,4-dichlorophenol	ND
A	2,4-dimethylphenol	ND
A	2-nitrophenol	ND
A	4-nitrophenol	ND
A	2,4-dinitrophenol	ND
A	4,6-dinitro-o-cresol	ND
A	pentachlorophenol	ND
	phenol	ND

	BASE/NEUTRAL COMPOUNDS	
	acenaphthene	ND
	benzidine	ND
	1,2,4-trichlorobenzene	ND
	hexachlorobenzene	ND
B	hexachloroethane	ND
B	bis(2-chloroethyl)ether	ND
B	2-chloronaphthalene	ND
B	1,2-dichlorobenzene	ND
B	1,3-dichlorobenzene	ND
B	1,4-dichlorobenzene	*
B	3,3-dichlorobenzidine	ND
B	2,4-dinitrotoluene	*
B	2,6-dinitrotoluene	ND
B	1,2-diphenylhydrazine	ND
B	fluoranthene	ND
B	4-chlorophenyl phenyl ether	ND

ND = Not detected
NA = Not applicable
* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	*
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	ND
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

Reported by: [signature]

ENERGY RESOURCES CO. INC.

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

ENT Geraghty & Miller

IENT I.D. LF-1

CO I.D. 13-1256

DATE SAMPLE RECEIVED 2/17/82

DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	ug/l
2,4,6-trichlorophenol	ND
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	ND
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	ND
pentachlorophenol	ND
phenol	ND
BASE/NEUTRAL COMPOUNDS	
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

	BASE NEUTRAL COMPOUNDS	
41B	4-bromophenyl phenyl ether	N
42B	bis(2-chloroisopropyl)ether	N
43B	bis(2-chloroethoxy)methane	N
52B	hexachlorobutadiene	N
53B	hexachlorocyclopentadiene	NI
54B	isophorone	NI
55B	naphthalene	NI
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	*
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	
67B	butyl benzyl phthalate	NL
68B	di-n-butyl phthalate	*
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

ND = Not detected

NA = Not applicable

* = 1-9 ug/l

Reported by: WKY

Checked by: C. Rodgers

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

ENT Geraghty & Miller

T I.D. LF-3 DATE SAMPLE RECEIVED 2/17/82

O I.D. 13-1257 DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	ug/l
2,4,6-trichlorophenol	ND
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	ND
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	ND
pentachlorophenol	ND
enol	ND

BASE/NEUTRAL COMPOUNDS	
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	18
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	ND
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

' = Not detected
= Not applicable
* = 1-9 ug/l

Reported by: ________

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller
IENT I.D. LF-4
O I.D. 13-1258

DATE SAMPLE RECEIVED 2/17/82
DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	ug/l
2,4,6-trichlorophenol	ND
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	ND
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	ND
pentachlorophenol	ND
phenol	ND

BASE/NEUTRAL COMPOUNDS	
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

ND = Not detected
NA = Not applicable
* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	ug/l
418	4-bromophenyl phenyl ether	ND
428	bis(2-chloroisopropyl)ether	ND
438	bis(2-chloroethoxy)methane	ND
528	hexachlorobutadiene	ND
538	hexachlorocyclopentadiene	ND
548	isophorone	ND
558	naphthalene	ND
568	nitrobenzene	ND
618	N-nitrosodimethylamine	ND
628	N-nitrosodiphenylamine	ND
638	N-nitrosodi-n-propylamine	ND
668	bis(2-ethylhexyl)phthalate	*
678	butyl benzyl phthalate	ND
688	di-n-butyl phthalate	*
698	di-n-octyl phthalate	ND
708	diethyl phthalate	*
718	dimethyl phthalate	ND
728	benzo(a)anthracene	ND
738	benzo(a)pyrene	ND
748	3,4-benzofluoranthene	ND
758	benzo(k)fluoranthene	ND
768	chrysene	ND
778	acenaphthylene	ND
788	anthracene	ND
798	benzo(ghi)perylene	ND
808	fluorene	ND
818	phenanthrene	ND
828	dibenzo(a,h)anthracene	ND
838	indeno(1,2,3-cd)pyrene	ND
848	pyrene	ND
1298	2,3,7,8-tetrachlorodibenzo-p-dioxin	N

Reported by: JAM

Checked by: C. R...

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller

I NT I.D. LE-6

CO I.D. 13-1248

DATE SAMPLE RECEIVED 2/17/82

DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	ug/l
2,4,6-trichlorophenol	*
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	*
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	*
pentachlorophenol	15
phenol	*

BASE/NEUTRAL COMPOUNDS	ug/l
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	*
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	*
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	*
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	*
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

ND = Not detected
\ = Not applicable
* = 1-9 ug/l

Reported by: [signature]

Checked by: [signature]

ENERGY RESOURCES CO. INC.

SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller

IENT I.D. LF-7

CO I.D. 13-1249

DATE SAMPLE RECEIVED 2/17/82

DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	ug/l
2,4,6-trichlorophenol	ND
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	ND
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	ND
pentachlorophenol	*
phenol	ND

BASE/NEUTRAL COMPOUNDS	
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	*
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

ND = Not detected

NA = Not applicable

* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	ug/l
418	4-bromophenyl phenyl ether	ND
429	bis(2-chloroisopropyl)ether	ND
438	bis(2-chloroethoxy)methane	ND
529	hexachlorobutadiene	ND
538	hexachlorocyclopentadiene	ND
548	isophorone	ND
558	naphthalene	ND
568	nitrobenzene	ND
618	N-nitrosodimethylamine	ND
628	N-nitrosodiphenylamine	ND
638	N-nitrosodi-n-propylamine	ND
668	bis(2-ethylhexyl)phthalate	90
678	butyl benzyl phthalate	N
688	di-n-butyl phthalate	ND
698	di-n-octyl phthalate	ND
708	diethyl phthalate	*
718	dimethyl phthalate	ND
728	benzo(a)anthracene	ND
738	benzo(a)pyrene	ND
748	3,4-benzofluoranthene	ND
758	benzo(k)fluoranthene	ND
768	chrysene	ND
778	acenaphthylene	ND
788	anthracene	ND
798	benzo(ghi)perylene	ND
808	fluorene	ND
818	phenanthrene	ND
828	dibenzo(a,h)anthracene	ND
838	indeno(1,2,3-cd)pyrene	ND
848	pyrene	ND
1298	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

Reported by: [signature]

Checked by: C Rodgers

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller

NT I.D. LF-8 DATE SAMPLE RECEIVED 2/17/82

CO I.D. 13-1250 DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	ug/l
2,4,6-trichlorophenol	ND
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	ND
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	ND
pentachlorophenol	ND
phenol	ND

BASE/NEUTRAL COMPOUNDS	
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

ND = Not detected
NA = Not applicable
* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	65
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	*
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

Reported by: [signature]

Checked by: [signature]

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller
IENT I.D. LF-9
CO I.D. 13-1251

DATE SAMPLE RECEIVED 2/17/82
DATE ANALYSIS COMPLETED 3/1/82

ACID COMPOUNDS	µg/l
2,4,6-trichlorophenol	ND
p-chloro-m-cresol	ND
2-chlorophenol	ND
2,4-dichlorophenol	ND
2,4-dimethylphenol	ND
2-nitrophenol	ND
4-nitrophenol	ND
2,4-dinitrophenol	ND
4,6-dinitro-o-cresol	ND
pentachlorophenol	ND
phenol	ND

BASE/NEUTRAL COMPOUNDS	
acenaphthene	ND
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

ND = Not detected
NA = Not applicable
* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	µg/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	ND
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	ND
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

Reported by: [signature]

Checked by: C [signature]

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller
: IT I.D. LF-10
:O I.D. 13-1252

DATE SAMPLE RECEIVED 2/17/82
DATE ANALYSIS COMPLETED 3/1/82

	ACID COMPOUNDS	ug/l
\	2,4,6-trichlorophenol	ND
\	p-chloro-m-cresol	ND
\	2-chlorophenol	ND
\	2,4-dichlorophenol	*
\	2,4-dimethylphenol	ND
\	2-nitrophenol	ND
\	4-nitrophenol	ND
\	2,4-dinitrophenol	ND
\	4,6-dinitro-o-cresol	ND
\	pentachlorophenol	ND
	henol	*

BASE/NEUTRAL COMPOUNDS	
acenaphthene	*
benzidine	ND
1,2,4-trichlorobenzene	ND
hexachlorobenzene	ND
hexachloroethane	ND
bis(2-chloroethyl)ether	ND
2-chloronaphthalene	ND
1,2-dichlorobenzene	ND
1,3-dichlorobenzene	ND
1,4-dichlorobenzene	ND
3,3-dichlorobenzidine	ND
2,4-dinitrotoluene	ND
2,6-dinitrotoluene	ND
1,2-diphenylhydrazine	ND
fluoranthene	ND
4-chlorophenyl phenyl ether	ND

) = Not detected
= Not applicable
* = 1-9 ug/l

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND.
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	23
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	*
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene /phenanthrene	*
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	See 78B
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

Reported by: [signature]

ENERGY RESOURCES CO. INC.
SUMMARY OF ORGANIC PRIORITY POLLUTANT ANALYSIS

IENT Geraghty & Miller
IENT I.D. Procedural Blank
CO I.D. 13-1253

DATE SAMPLE RECEIVED 2/17/92
DATE ANALYSIS COMPLETED 3/1/92

	ACID COMPOUNDS	ug/l
A	2,4,6-trichlorophenol	ND
A	p-chloro-m-cresol	ND
A	2-chlorophenol	ND
A	2,4-dichlorophenol	ND
A	2,4-dimethylphenol	ND
A	2-nitrophenol	ND
A	4-nitrophenol	ND
A	2,4-dinitrophenol	ND
A	4,6-dinitro-o-cresol	ND
A	pentachlorophenol	ND
A	phenol	ND

	BASE/NEUTRAL COMPOUNDS	ug/l
	acenaphthene	ND
	benzidine	ND
	1,2,4-trichlorobenzene	ND
	hexachlorobenzene	ND
B	hexachloroethane	ND
B	bis(2-chloroethyl)ether	ND
B	2-chloronaphthalene	ND
B	1,2-dichlorobenzene	ND
B	1,3-dichlorobenzene	ND
B	1,4-dichlorobenzene	ND
B	3,3-dichlorobenzidine	ND
B	2,4-dinitrotoluene	ND
B	2,6-dinitrotoluene	ND
B	1,2-diphenylhydrazine	ND
B	fluoranthene	ND
B	4-chlorophenyl phenyl ether	ND

	BASE NEUTRAL COMPOUNDS	ug/l
41B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
43B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
53B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
55B	naphthalene	ND
56B	nitrobenzene	ND
61B	N-nitrosodimethylamine	ND
62B	N-nitrosodiphenylamine	ND
63B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	3*
67B	butyl benzyl phthalate	ND
68B	di-n-butyl phthalate	ND
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	ND
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

ND = Not detected
NA = Not applicable
* = 1-9 ug/l

Reported by: [signature]

Checked by: C. [signature]

Sample Rcvd: 7/30/81

Date Analysis Completed: 8/7/81

All Results In: mg/l

Reported By:

Checked By:

ENERGY RESOURCES CO. INC.

VOLATILE ORGANICS ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller

Compounds (in order of elution)	DLP-1	SLP-1	SLP-2
Vinyl chloride			
Methylene chloride		0.09	0.57
1,1-dichloroethylene			
1,1-dichloroethane			
trans-1,2-dichloroethylene			
1,2-dichloroethane			
1,1,1-trichloroethane			
1,2-Dichloropropane			
Trichloroethylene			
1,1,2-Trichloroethane			
Tetrachloroethylene			
Chlorobenzene			
Unknown			

Comments: All blank spaces are ND's (none detected) (<0.05 mg/l, or 50 ppb)

Sample Rcvd: 7/30/81
Date Analysis
Completed: 8/7/81
All Results In: mg/l
Reported By:
Checked By:

ENERGY RESOURCES CO. INC.

VOLATILE ORGANICS ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller

Compounds (in order of elution)	LP-1	LP-2	LP-3	LP-4	LP-5
Vinyl chloride					
Methylene chloride	0.07		0.22		
1,1-dichloroethylene					
1,1-dichloroethane					
trans-1,2-dichloroethylene					
1,2-dichloroethane					
1,1,1-trichloroethane					
1,2-Dichloropropane					
Trichloroethylene					
1,1,2-Trichloroethane					
Tetrachloroethylene					
Chlorobenzene		0.05			
Unknown					

Comments: All blank spaces are ND's (none detected) (<0.05 mg/l, or 50 ppb)

Sample Rcvd: 2/17/82
Date Analysis Completed: 3/15/82
All Results In: ug/l (ppb)
Reported By:
Checked By:

Analyzed for: G & H SC Navy

ENERGY RESOURCES CO. INC.

VOLATILE ORGANICS ANALYSIS

- Report Sheet -

Compounds (in order of elution)	LP-6 13-1248	LP-7 13-1249*	LP-8 13-1250	LP-9 13-1251	LP-10 13-1252**
Vinyl chloride		24			
Methylene chloride	3.2	2.2	650	1600	145
1,1-dichloroethylene					
1,1-dichloroethane					
1,2-dichloroethylene					
Chloroform	5.4	1.2	1.3	3.1	
1,2-dichloroethane					
1,1,1-trichloroethane					
Carbon tetrachloride					
Bromodichloromethane					
Trichloroethylene					
Dibromochloromethane			2.5	3.4	
Bromoform					
Tetrachloroethylene					

Comments: All blank spaces are ND's (none detected).
*2.9 ppb chlorobenzene
**~2 ppb. 1,2-dichloropropane (tentati ID)

ENERGY RESOURCES CO. INC

PCB ANALYSIS

Sample Rcvd: 2/17/82

Date Analysis Completed: 3/22/82

All Results In: µg/l (ppb)

Reported By: [signature]

Checked By: [signature]

Analyzed for: Geraghty & Miller

Client ID:	DET. LIMIT	LF-6 13-1248	LF-7 13-1249	LF-8 13-1250	LF-9 13-1251	LF-10 13-1252	Procedural Blank 13-1253	SLF-1 13-1254	SLF-2 13-1255	LF-1 13-1256	LF-3 13-1257	LF-4 13-1258
Aroclor 1221	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1016	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	0.1	0.1	ND	<.1	ND	ND	ND	ND	<.1	<.1	ND	ND
Aroclor 1260	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1262	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Comments:

ND = not detected.

pH MEASUREMENTS OF WATER SAMPLES
COLLECTED FROM MONITOR WELLS
AT THE LANDFILL AREA[1]

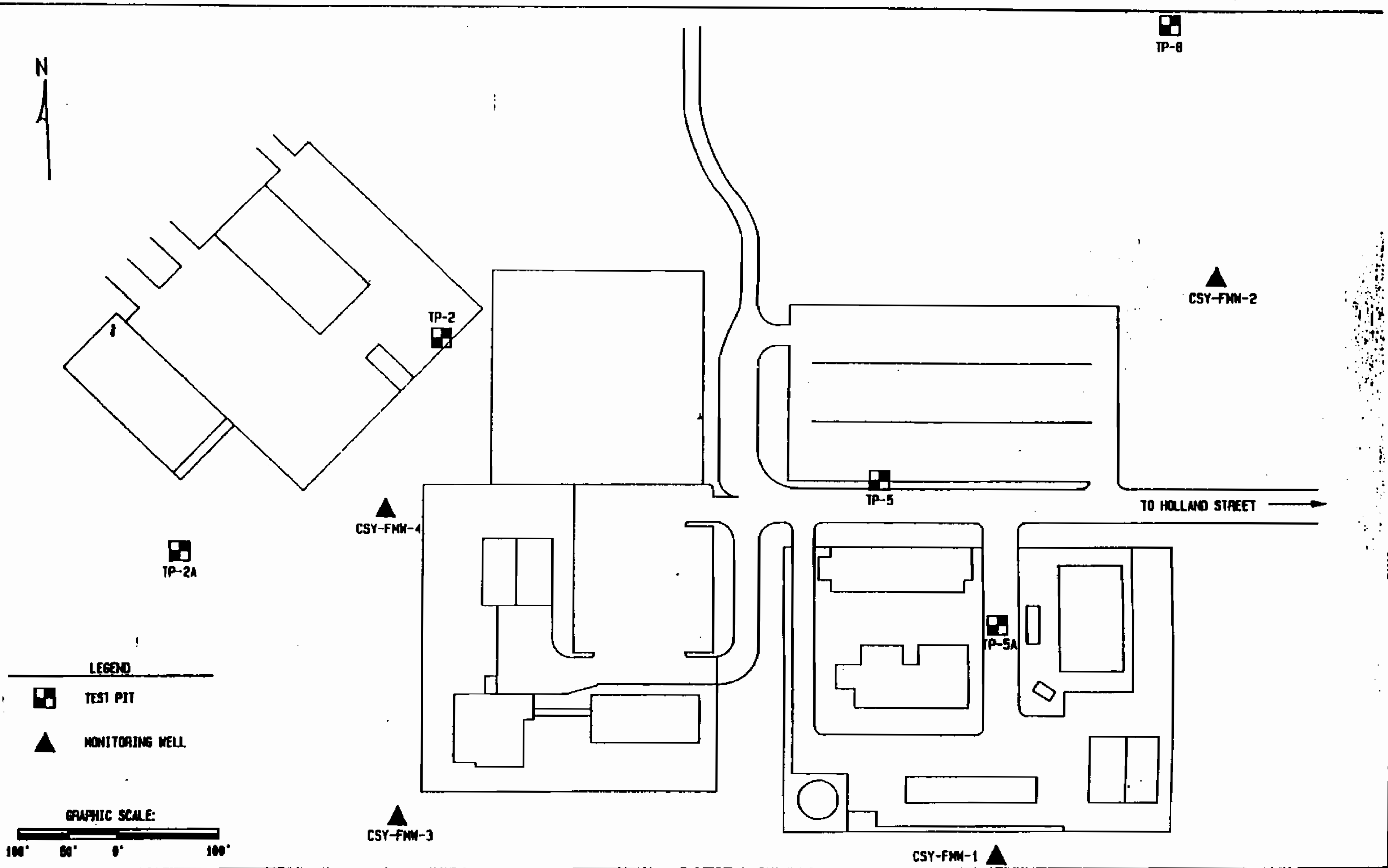
Well Number	pH 7/28/81	pH 2/15/82
LF-1	7.40	7.20
LF-2	7.55	-
LF-3	7.40	7.39
LF-4	7.35	7.32
LF-5	7.80	-
LF-6	-	8.02
LF-7	-	7.02
LF-8	-	7.50
LF-9	-	7.19
LF-10	-	8.74
SLF-1	-	7.04
SLF-2	7.70	7.42
DLF-1	8.85	-

[1] Measured at the time of sample collection.

APPENDIX I-2

CLOSED LANDFILL - TEST PIT OBSERVATIONS/LOGS AND ANALYTICAL DATA

(Source: Reference 17)



1" = 100'	DRAWN BY: WJM	REVISION DATE:	Westinghouse Environmental and Geotechnical Services, Inc. 840 Low Country Boulevard Mt. Pleasant, South Carolina 29646 (803) 884-0005	TITLE: SITE PLAN CHARLESTON NAVAL BASE ADVANCED FIRE FIGHTING CHARLESTON, SOUTH CAROLINA	FIGURE: 2
4-18-91	CHECKED BY:	REVISION DATE:			
CSWA219	PROVED BY:	REVISION DATE:			

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

Ground Water Protection Division 2600 Bull Street Columbia, S.C. 29201 (803) 758-5213 Water Well Recor

1. LOCATION OF WELL

County: Charleston System Name: CSY-FMW-3

Latitude: 32° 51' Longitude: 79° 57'

Distance And Direction from Road Intersections

1700' southwest of Bainbridge and Holland

Street Address & City of Well Location

Sketch Map: (See example on back)

See Attached

2. CUTTING SAMPLES [x] Yes [ ] No

Geophysical Logs [ ] Yes (Please enclose) [x] No

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
rown Silty Sand	.5'	.5'
Gray Sandy Clay	1.5'	2'
Brown Silty Clay	3.5'	5.5'
Gray Clay	2'	7.5'

Indicate water bearing zones

1.2' - 5.5+

(use a 2nd sheet if needed)

3. REMARKS

4. OWNER OF WELL

Address Charleston Naval Base

Telephone No.

Engineer Address Saussy Engineering
230 Habersham Street
Savannah, GA 31412 (912) 223-5103

Telephone No

5. WELL DEPTH (Completed) ~~5.5~~ 5.5 ft.

Date Started 04-11-91

Date Completed 04-11-91

6. [ ] Mud Rotary [ ] Jetted [x] Bored [ ] Dug
[ ] Air Rotary [ ] Driven [ ] Cable tool [ ] Other

7. USE:
[ ] Domestic [ ] Public Supply Permit No [ ] Ind.
[ ] Irrigation [ ] Air Conditioning [ ] Com
[x] Test Well [ ]

8. CASING [x] Threaded [ ] Welded

Diam.

Type [x] PVC [ ] Galvanized
[ ] Steel [ ] Other

2 in. to .5 ft. depth

in. to ft. depth

Height Above/Below Surface 0 ft.

Weight lbs./ft.

Drive Shoe? [ ] Yes [ ] No

9. SCREEN

Type PVC Diam. 2"

Slot/Gauge 10 Length 5'

Set Between .5 ft. and 5.5 ft. NOTE: MULTIPLE SCR USE SECOND SHEET

ft. and ft.

Sieve Analysis [ ] Yes (Please enclose) [x] No

10. STATIC WATER LEVEL

1.2' ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface

ft. after hrs. pumping G.P.M.

Pumping Test [ ] Yes (Please enclose) [x] No

Yield

12. WATER QUALITY

Chemical Analysis [x] Yes [ ] No Bacterial Analysis [ ] Yes [x] No

Please Enclose Lab Results

13. ARTIFICIAL FILTER (Gravel Pack) [x] Yes [ ] No

Installed from .5 ft. to 5.5 ft.

Effective size 0.513 uniformity coefficient 1.466

14. WELL GROUTED? [x] Yes [ ] No

Neat Cement [ ] Sand Cement [ ] Concrete [x] Other [x] Benton

Depth From 0.5 ft. to surface

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION ft. Dir.

Type Well disinfected upon completion [ ] Yes [ ] No Type Amount

16. PUMP Date Installed not installed [x]

Mfr. name model no.

H.P. volts length of drop pipe ft. capacity

TYPE: [ ] Submersible [ ] Jet (shallow) [ ] Turbine
[ ] Jet (deep) [ ] Reciprocating [ ] Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my di and this report is true to the best of my knowledge and belief.

REGISTERED BUSINESS NAME Hardin-Huber

ADDRESS 1053 E. Lindsay Greensboro, NC

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

Ground Water Protection Division **2600 Bull Street** **Columbia, S.C. 29201** **(803) 758-5213** **Water Well Recor**

4. OWNER OF WELL
Address: Charleston Naval Base

Telephone No.

Engineer Address: Saussy Engineering
230 Habersham Street
Savannah, GA 31412 (912) 223-5103
Telephone No

1. LOCATION OF WELL

County: Charleston System Name: CSY-FMW-4

Latitude: 32° 51' Longitude: 79 57'

Distance And Direction from Road Intersections

1500' soutwest of Bainbridge and Holland

Street address & City of Well Location

Sketch Map (See example on back)

See Attached

5. WELL DEPTH (Completed) 7.5 ft. Date Started: 04-11-91 Date Completed: 04-11-91

6. [ ] Mud Rotary [ ] Jetted [X] Bored [ ] Dug
[ ] Air Rotary [ ] Driven [ ] Cable tool [ ] Other

7. USE: [ ] Domestic [ ] Public Supply Permit No ______ [ ] [illegible]
[ ] Irrigation [ ] Air Conditioning [ ] Co[illegible]
[X] Test Well [ ] ______

8. CASING: [X] Threaded [ ] Welded
Diam.
Type: [X] PVC [ ] Galvanized [ ] Steel [ ] Other
2 in. to 2.5 ft. depth
___ in. to ___ ft. depth

Height: Above/Below Surface 0 ft.
Weight ______ lbs./ft.
Drive Shoe? [ ] Yes [X] No

2. CUTTING SAMPLES [x] Yes [ ] No

Geophysical Logs [ ] Yes (Please enclose) [x] No

9. SCREEN:
Type: PVC Diam.: 2"
Slot/Gauge: 10 Length: 5
Set Between 2.5 ft. and 7.5 ft. NOTE: MULTIPLE SCR[EENS] USE SECOND SHEET
___ ft. and ___ ft.
Sieve Analysis [ ] Yes (Please enclose) [X] No

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Silty Sand	5'	5'
(w/tar beween 2-3.5')		
Light Brown Sandy Clay	2.5'	7.5'
With Organics		

Indicate water bearing zones
1.75' - 7.5'+
(use a 2nd sheet if needed)

10. STATIC WATER LEVEL
1.75 ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface
______ ft. after ______ hrs. pumping ______ G.P.M.
Pumping Test: [ ] Yes (Please enclose) [X] No
Yield ______

12. WATER QUALITY
Chemical Analysis [X] Yes [ ] No Bacterial Analysis [ ] Yes [X] No
Please Enclose Lab Results

13. ARTIFICIAL FILTER (Gravel Pack) [X] Yes [ ] No
Installed from 1.5 ft. to 7.5 ft.
Effective size ______ uniformity coefficient 1.466

14. WELL GROUTED? [ ] Yes [ ] No
Neat Cement [ ] Sand Cement [ ] Concrete [X] Other [X] Benton[ite]
Depth: From 1.5 ft. to surface

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION ______ Feet ______ [illegible]
______ Type Well disinfected [ ] Yes Type ______
upon completion [ ] No Amount ______

16. PUMP Date installed ______ not installed [X]
Mfr. name ______ model no. ______
H.P. ______ volts ______ length of drop pipe ______ ft. capacity ______
TYPE: [ ] Submersible [ ] Jet (shallow) [ ] Turbine
[ ] Jet (deep) [ ] Reciprocating [ ] Centrifugal

3. REMARKS

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under m[y direction] and this report is true to the best of my knowledge and belief.

REGISTERED BUSINESS NAME: Hardin-Huber ADDRESS: 1053 E. Lindsay[...] Greensboro, NC [...]

[signature] CERT. NO. 855

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

Ground Water Protection Division 2600 Bull Street Columbia, S.C. 29201 (803) 758-5213 Water Well Record

1. LOCATION OF WELL

County: Charleston System Name: CSY-FMW-2

Latitude: 32° 51' Longitude: 79° 57'

Distance And Direction from Road Intersections

800' south of Holland and Bainbridge

Street address & City of Well Location

Sketch Map: (See example on back)

See Attached

2. CUTTING SAMPLES [x] Yes [ ] No

Geophysical Logs [ ] Yes (Please enclose) [x] No

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
rown-Black Silty Sand	3'	3'
(Topsoil)		
Tar, Trash, Sand	4.5	7.5

Indicate water bearing zones

3.45' - 7.5+

(use a 2nd sheet if needed)

3. REMARKS

4. OWNER OF WELL

Address Charleston Naval Base

Telephone No.

Engineer Address Saussy Engineering
230 Habersham Street
Savannah, GA 31412 (912) 223-5103

Telephone No

5. WELL DEPTH (Completed) 7.5 ft. Date Started 04-11-91 Date Completed 04-11-91

6. [ ] Mud Rotary [ ] Jetted [x] Bored [ ] Dug
[ ] Air Rotary [ ] Driven [ ] Cable tool [ ] Other

7. USE: [ ] Domestic [ ] Public Supply Permit No. [ ] ...
[ ] Irrigation [ ] Air Conditioning [ ] ...
[x] Test Well [ ]

8. CASING [x] Threaded [ ] Welded

Diam.

Type [x] PVC [ ] Galvanized
[ ] Steel [ ] Other

2 in. to 2.5 ft. depth

in. to ft. depth

Height Above/Below Surface 0 ft.

Weight lbs./ft.

Drive Shoe? [ ] Yes [x] No

9. SCREEN

Type PVC Diam. 2"

Slot/Gauge 10 Length 5'

Set Between 2.5 ft. and 7.5 ft. NOTE: MULTIPLE SCREENS USE SECOND SHEET

ft. and ft.

Sieve Analysis [ ] Yes (Please enclose) [x] No

10. STATIC WATER LEVEL

3.45' ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface

ft. after hrs. pumping G.P.M.

Pumping Test [ ] Yes (Please enclose) [x] No

Yield

12. WATER QUALITY

Chemical Analysis [x] Yes [ ] No Bacterial Analysis [ ] Yes [x] No

Please Enclose Lab Results

13. ARTIFICIAL FILTER (Gravel Pack) [x] Yes [ ] No

Installed from 1.5 ft. to 7.5 ft.

Effective size uniformity coefficient 1.466

14. WELL GROUTED? [ ] Yes [ ] No

Neat Cement [ ] Sand Cement [ ] Concrete [x] Other [x] Bentoni...

Depth From ft. to ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION: Feet Direction

Type Well disinfected upon completion [ ] Yes [ ] No Type Amount

16. PUMP Date Installed not installed [x]

Mfr. name model no.

H.P. volts length of drop pipe ft. capacity

TYPE: [ ] Submersible [ ] Jet (shallow) [ ] Turbine
[ ] Jet (deep) [ ] Reciprocating [ ] Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

REGISTERED BUSINESS NAME Hardin-Huber ADDRESS 1053 E. Lindsay Greensboro, NC ...

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

Ground Water Protection Division — 2600 Bull Street — Columbia, S.C. 29201 — (803) 758-5213 — Water Well Record

1. LOCATION OF WELL

County: Charleston — System Name: CSY-FMW-1

Latitude: 32° 51' — Longitude: 79° 57'

Distance And Direction from Road Intersections

1500' south of Holland and Bainbridge

Street address & City of Well Location

Sketch Map (See example on back)

See Attached

2. CUTTING SAMPLES [x] Yes [ ] No

Geophysical Logs [ ] Yes (Please enclose) [x] No

FORMATION DESCRIPTION	THICKNESS OF STRATUM	DEPTH TO BOTTOM OF STRATUM
Brown Silty Sand	3'	3'
Black Silty Clay	4.5+	7.5
* Indicate water bearing zones '5' - 7.5'+ (use a 2nd sheet if needed)		

3. REMARKS

4. OWNER OF WELL

Address: Charleston Naval Base

Telephone No

Engineer Address: Saussy Engineering
230 Habersham Street
Savannah, GA 31412 (912) 223-5103

Telephone No

5. WELL DEPTH (Completed) 7.5 ft. — Date Started 04-11-91 — Date Completed 04-11-91

6. [ ] Mud Rotary [ ] Jetted [x] Bored [ ] Dug
[ ] Air Rotary [ ] Driven [ ] Cable tool [ ] Other

7. USE: [ ] Domestic [ ] Public Supply Permit No ____ [ ] Industrial
[ ] Irrigation [ ] Air Conditioning [ ] Commercial
[xx] Test Well [ ] ____

8. CASING: [x] Threaded [ ] Welded

Diam.: — Type: [x] PVC [ ] Galvanized [ ] Steel [ ] Other

2 in. to 2.5 ft. depth

____ in. to ____ ft. depth

Height Above/Below Surface 0 ft.

Weight ____ lbs./ft.

Drive Shoe? [ ] Yes [x] No

9. SCREEN:

Type PVC — Diam. 2"

Slot/Gauge 10 — Length 5'

Set Between 2.5 ft. and 7.5 ft. — NOTE: MULTIPLE SCREENS USE SECOND SHEET

____ ft. and ____ ft.

Sieve Analysis [ ] Yes (Please enclose) [x] No

10. STATIC WATER LEVEL 1.75 ft. below land surface after 24 hours

11. PUMPING LEVEL Below Land Surface

____ ft. after ____ hrs. pumping ____ G.P.M.

Pumping Test [ ] Yes (Please enclose) [x] No

Yield ____

12. WATER QUALITY

Chemical Analysis [x] Yes [ ] No — Bacterial Analysis [ ] Yes [x] No

Please Enclose Lab Results

13. ARTIFICIAL FILTER (Gravel Pack) [x] Yes [ ] No

Installed from 1.5 ft. to 7.5 ft.

Effective size ____ uniformity coefficient 1.466

14. WELL GROUTED? [ ] Yes [ ] No

Neat Cement [ ] Sand Cement [ ] Concrete [x] Other [x] Bentonite

Depth: From 1.5 ft. to surface ft.

15. NEAREST SOURCE OF POSSIBLE CONTAMINATION ____ Feet ____ Direction

____ Type — Well disinfected upon completion [ ] Yes [ ] No — Type ____ Amount ____

16. PUMP: Date Installed ____ not installed [x]

Mfr. name ____ model no. ____

H.P. ____ volts ____ length of drop pipe ____ ft. capacity ____ gpm

TYPE: [ ] Submersible [ ] Jet (shallow) [ ] Turbine
[ ] Jet (deep) [ ] Reciprocating [ ] Centrifugal

17. WATER WELL CONTRACTOR'S CERTIFICATION: This well was drilled under my direction and this report is true to the best of my knowledge and belief.

REGISTERED BUSINESS NAME: Hardin-Huber — ADDRESS: 1053 E. Lindsay, Greensboro, NC 27...

Signed: Dan Fowler for Rodney Fowler — CERT. NO. 855 — Date 5/15/91

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	TP-2/TRAIN. CNT.	EPA:	# FLO95
SAMPLE NUMBER	002-041291	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/12/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/11/91	GEORGIA:	# 828
SAMPLE TYPE	SOIL	SOUTH CAROLINA:	# 96015
SUBMITTER	DIRECT EXPRESS		

TEST		RESULTS	
LEAD,T	3050/7421	170.0	MG/KG D.W.
ARSENIC,T	3050/7060	4.60	MG/KG D.W.
BARIUM,T	3050/7080	35.	MG/KG D.W.
CADMIUM,T	3050/7131	.20	MG/KG D.W.
CHROMIUM,T	3050/7191	11.0	MG/KG D.W.
SELENIUM,T	3050/7740	.20	MG/KG D.W.
MERCURY,T	7471	<0.1	MG/KG D.W.
SILVER,T	3050/7760	<0.1	MG/KG D.W.
EPA 8240		NEGATIVE	
EPA 8270		POSITIVE	
pH OF SOLID	9045	8.0	

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE
SAMPLE: 002-041291/ TP-2 TRAIN. CNT. #219
DATA FILE: >41615::D4
DATE REPORTED: 4/17/91 2:28
DILUTION FACT: 5.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8240
PURGEABLE ORGANICS - SOILS -

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)	CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/k
67-64-1	ACETONE	0.0	5.00	95-50-1	o-DICHLOROBENZENE	0.0	1.00
75-05-8	ACETONITRILE	0.0	10.0	541-73-1	m-DICHLOROBENZENE	0.0	1.00
107-02-8	ACROLEIN	0.0	80.0	106-46-7	p-DICHLOROBENZENE	0.0	1.00
107-13-1	ACRYLONITRILE	0.0	20.0	156-60-5	trans,1,2-DICHLOROETHENE	0.0	1.00
71-43-2	BENZENE	0.0	1.00	78-87-5	1,2-DICHLOROPROPANE	0.0	1.00
100-44-7	BENZYL CHLORIDE	0.0	1.00	10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	1.00
75-27-4	BROMODICHLOROMETHANE	0.0	1.00	10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	1.00
75-25-2	BROMOFORM	0.0	1.00	100-41-4	ETHYLBENZENE	0.0	1.00
74-83-9	BROMOMETHANE	0.0	5.00	591-78-6	HEXANE	0.0	1.00
78-93-3	2-BUTANONE (MEK)	0.0	10.0	78-83-1	ISOBUTYL ALCOHOL	0.0	20.0
75-15-0	CARBON DISULFIDE	0.0	5.00	75-09-2	METHYLENE CHLORIDE	0.0	5.00
56-23-53	CARBON TETRACHLORIDE	0.0	1.00	108-10-1	4-METHYL-2-PENTANONE	0.0	10.0
108-90-7	CHLOROBENZENE	0.0	1.00	109-06-8	2-PICOLINE	0.0	[illegible]
124-48-1	CHLORODIBROMOMETHANE	0.0	1.00	110-86-1	PYRIDINE	0.0	
75-00-3	CHLOROETHANE	0.0	5.00	100-42-5	STYRENE	0.0	1.00
110-75-8	2-CHLOROETHYLVINYLETHER	0.0	5.00	630-20-6	1,1,1,2-TETRACHLOROETHANE	0.0	1.00
67-66-3	CHLOROFORM	0.0	1.00	79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	1.00
74-87-3	CHLOROMETHANE	0.0	1.00	127-18-4	TETRACHLOROETHENE	0.0	1.00
96-12-8	1,2-DIBROMO-3-CHLOROPRO	0.0	1.00	108-88-3	TOLUENE	0.0	1.00
106-93-4	1,2-DIBROMOETHANE	0.0	1.00	71-55-6	1,1,1-TRICHLOROETHANE	0.0	1.00
74-95-3	DIBROMOMETHANE	0.0	1.00	79-00-5	1,1,2-TRICHLOROETHANE	0.0	1.00
764-41-0	1,4-DICHLORO-2-BUTENE	0.0	5.00	79-01-6	TRICHLOROETHENE	0.0	1.00
75-71-8	DICHLORODIFLUOROMETHANE	0.0	5.00	75-69-4	TRICHLOROFLUOROMETHANE	0.0	5.00
75-34-3	1,1-DICHLOROETHANE	0.0	1.00	96-18-4	1,2,3-TRICHLOROPROPANE	0.0	1.00
107-06-2	1,2-DICHLOROETHANE	0.0	1.00	108-05-4	VINYL ACETATE	0.0	5.00
75-35-4	1,1-DICHLOROETHENE	0.0	1.00	75-01-4	VINYL CHLORIDE	0.0	1.00
				1330-20-7	TOTAL XYLENES	0.0	1.00

LYLE A. JOHNSON - Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FAC
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 002-041291/ TP-2 TRAIN CNT #219
DATA FILE: >4B11A::D3
DATE REPORTED: 4/17/91 2:37
DILUTION FACT: 100.0000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
83-32-9	ACENAPHTHENE	BMDL	0.50
208-96-8	ACENAPHTHYLENE	BMDL	0.50
98-86-2	ACETOPHENONE	BMDL	0.50
309-00-2	ALDRIN	BMDL	0.50
101-05-3	ANILAZINE	BMDL	10.0
62-53-3	ANILINE	BMDL	0.75
120-12-7	ANTHRACENE	BMDL	1.00
12674-11-2	AROCHLOR-1016	BMDL	5.00
11104-28-2	AROCHLOR-1221	BMDL	5.00
11141-16-5	AROCHLOR-1232	BMDL	5.00
53469-21-9	AROCHLOR-1242	BMDL	5.00
12672-29-6	AROCHLOR-1248	BMDL	5.00
11097-69-1	AROCHLOR-1254	BMDL	5.00
11096-82-5	AROCHLOR-1260	BMDL	5.00
86-50-0	AZINPHOS METHYL "GUTHION"	BMDL	5.00
01-27-9	BARBAN	BMDL	5.00
-87-5	BENZIDINE	BMDL	20.0
65-85-0	BENZOIC ACID	BMDL	25.0
56-55-3	BENZO(a)ANTHRACENE	BMDL	0.75
205-99-2	BENZO(b)FLUORANTHENE	BMDL	0.75
207-08-9	BENZO(k)FLUORANTHENE	BMDL	1.00
191-24-2	BENZO(ghi)PERYLENE	BMDL	0.85
50-32-8	BENZO(a)PYRENE	BMDL	1.00
106-51-4	p-BENZOQUINONE	BMDL	1.00
100-51-6	BENZYL ALCOHOL	BMDL	1.00
319-84-6	BHC-alpha	BMDL	1.00
319-85-7	BHC-beta	BMDL	1.00
319-86-8	BHC-delta	BMDL	1.00
58-89-9	BHC-gamma "LINDANE"	BMDL	1.00
111-91-1	BIS(2-CHLOROETHOXY)METHANE	BMDL	1.00
111-44-4	BIS(2-CHLOROETHYL)ETHER	BMDL	1.00
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	BMDL	1.00
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	BMDL	1.00
101-55-3	4-BROMODIPHENYLETHER	BMDL	0.50
1689-84-5	BROMOXYNIL	BMDL	5.00
85-68-7	BUTYLBENZYLPHTHALATE	3580	1.00
2425-06-1	CAPTAFOL	BMDL	5.00
133-06-2	CAPTAN	BMDL	2.50
63-25-2	CARBARYL	BMDL	1.00
1563-66-2	CARBOFURAN	BMDL	1.00
786-19-6	CARBOPHENOTHION	BMDL	1.50
57-74-9	CHLORDANE	BMDL	5.00
470-90-6	CHLORFEVINPHOS	BMDL	1.00
106-47-8	4-CHLOROANILINE	BMDL	2.50
510-15-6	CHLOROBENZILATE	BMDL	1.00
59-50-7	4-CHLORO-3-METHYLPHENOL	BMDL	10.0
91-58-7	2-CHLORONAPHTHALENE	BMDL	1.00
95-57-8	2-CHLOROPHENOL	BMDL	1.00
005-72-3	4-CHLORODIPHENYLETHER	BMDL	1.00
3-01-9	CHRYSENE	BMDL	2.50
6-72-4	COUMAPHOS	BMDL	2.50
7700-17-6	CROTOXYPHOS	BMDL	5.00
72-54-8	p'p'-DDD	BMDL	1.00
72-55-9	p'p'-DDE	BMDL	1.00
50-29-3	p'p'-DDT	BMDL	5.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
298-03-3	DEMETON-o	BMDL	1.00
126-75-0	DEMETON-s	BMDL	1.00
2303-16-4	cis-DIALLATE	BMDL	1.00
2303-16-4	trans-DIALLATE	BMDL	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	BMDL	1.00
132-64-9	DIBENZOFURAN	BMDL	1.00
84-74-2	DI-n-BUTYLPHTHALATE	BMDL	1.00
117-80-6	DICHLONE	BMDL	5.00
95-50-1	1,2-DICHLOROBENZENE	BMDL	1.00
541-73-1	1,3-DICHLOROBENZENE	BMDL	1.00
106-46-7	1,4-DICHLOROBENZENE	BMDL	1.00
91-94-1	3,3-DICHLOROBENZIDINE	BMDL	20.0
120-83-2	2,4-DICHLOROPHENOL	BMDL	20.0
62-73-7	DICHLORVOS	BMDL	5.00
141-66-2	DICROTOPHOS	BMDL	5.00
60-57-1	DIELDRIN	BMDL	2.50
84-66-2	DIETHYLPHTHALATE	BMDL	1.00
60-51-5	DIMETHOATE	BMDL	2.50
105-67-9	2,4-DIMETHYLPHENOL	BMDL	2.00
131-11-3	DIMETHYLPHTHALATE	BMDL	1.00
528-29-0	m-DINITROBENZENE	BMDL	10.0
534-52-1	4,6-DINITRO-2-METHYLPHENOL	BMDL	40.0
51-28-5	2,4-DINITROPHENOL	BMDL	10.0
121-14-2	2,4-DINITROTOLUENE	BMDL	10.0
606-20-2	2,6-DINITROTOLUENE	BMDL	10.0
88-85-7	DINOSEB	BMDL	5.00
122-39-4	DIPHENYLAMINE	BMDL	2.50
122-66-7	1,2-DIPHENYLHYDRAZINE	BMDL	5.00
117-84-0	DI-n-OCTYLPHTHALATE	BMDL	5.00
298-04-4	DISULFOTON	BMDL	1.00
959-98-8	ENDOSULFAN I	BMDL	5.00
33212-65-9	ENDOSULFAN II	BMDL	5.00
1031-07-8	ENDOSULFAN SULFATE	BMDL	5.00
72-20-8	ENDRIN	BMDL	5.00
	ENDRIN KETONE	BMDL	1.00
2104-64-5	EPN	BMDL	1.00
563-12-2	ETHION	BMDL	1.00
52-85-7	FAMPHUR	BMDL	1.00
55-38-9	FENTHION	BMDL	1.00
33245-39-5	FLUCHLORALIN	BMDL	1.00
86-73-7	FLUORENE	BMDL	1.00
76-44-8	HEPATACHLOR	BMDL	1.00
1024-57-3	HEPTACHLOR EPOXIDE	BMDL	1.00
118-74-1	HEXACHLOROBENZENE	BMDL	1.00
87-68-3	HEXACHLOROBUTADIENE	BMDL	1.00
77-47-4	HEXACHLOROCYCLOPENTADIENE	BMDL	1.00
67-72-1	HEXACHLOROETHANE	BMDL	1.00
123-31-9	HYDROQUINONE	BMDL	1.00
193-39-5	INDENO(1,2,3-cd)PYRENE	BMDL	1.00
465-73-6	ISODRIN	BMDL	1.00
78-59-1	ISOPHORONE	BMDL	1.00
143-50-0	KEPONE	BMDL	1.00
21609-90-5	LEPTOPHOS	BMDL	1.00

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 002-041291/ TP-2 TRAIN CNT #219
DATA FILE: >4B11A::D3

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

MISCELLANEOUS ANALYTES

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)	CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
72-43-5	METHOXYCHLOR-p'p'	BMDL	5.00	30560-19-1	ACEPHATE	BMDL	10.0
90-12-0	1-METHYLNAPHTHALENE	380	1.00	76-06-2	CHLORPICRIN	BMDL	5.00
91-57-6	2-METHYLNAPHTHALENE	560	1.00	2675-77-6	CHLORNEB	BMDL	1.00
298-00-0	METHYL PARATHION	BMDL	1.00	5598-13-0	CHLORPYRIFOS "DURSBAN"	BMDL	1.00
95-48-7	2-METHYLPHENOL "o-CRESOL"	BMDL	5.00	99-30-9	DICHLORAN "BOTRAN"	BMDL	1.00
108-39-4	3-METHYLPHENOL "m-CRESOL"	BMDL	5.00	333-41-5	DIAZINON	BMDL	1.00
106-44-5	4-METHYLPHENOL "p-CRESOL"	BMDL	5.00	120-36-5	DICHLORPROP	BMDL	10.0
7786-34-7	MEVINPHOS	BMDL	1.00	957-51-7	DIPHENAMID	BMDL	1.00
2385-85-5	MIREX	BMDL	5.00	25311-71-1	ISOFENPHOS	BMDL	5.00
6923-22-4	MONOCROTOPHOS	BMDL	5.00	150-50-5	MERPHOS	BMDL	1.00
300-76-5	NALED	BMDL	5.00	114-26-1	PROPUXUR	BMDL	5.00
91-20-3	NAPHTHALENE	400	1.00	206-44-0	FLUORANTHENE	590	1.00
130-15-4	1,4-NAPHTHOQUINONE	BMDL	5.00				
54-11-5	NICOTINE	BMDL	10.0				
98-95-3	NITROBENZENE	BMDL	5.00				
1836-75-5	NITROFEN	BMDL	5.00				
88-75-5	2-NITROPHENOL	BMDL	5.00				
100-02-7	4-NITROPHENOL	BMDL	5.00				
62-75-9	n-NITROSODIMETHYLAMINE	BMDL	10.0				
86-30-6	n-NITROSODIPHENYLAMINE	BMDL	10.0				
621-64-7	n-NITROSODI-n-PROPYLAMINE	BMDL	10.0				
56-38-2	PARATHION	BMDL	1.00				
82-68-3	PENTACHLORONITROBENZENE	BMDL	1.00				
87-86-5	PENTACHLOROPHENOL	BMDL	5.00				
85-01-8	PHENANTHRENE	BMDL	1.00				
108-95-2	PHENOL	BMDL	1.00				
298-02-2	PHORATE	BMDL	1.00				
732-11-6	PHOSMET	BMDL	1.00				
13171-21-6	PHOSPHAMIDON	BMDL	5.00				
109-06-8	2-PICOLINE	BMDL	10.0				
23950-58-5	PRONAMIDE	BMDL	1.00				
129-00-0	PYRENE	500	1.00				
110-86-1	PYRIDINE	BMDL	10.0				
13071-79-9	TERBUFOS	BMDL	5.00				
95-94-3	1,2,4,5-TETRACHLOROBENZENE	BMDL	1.00				
961-11-5	TETRACHLORVINPHOS	BMDL	5.00				
8001-35-2	TOXAPHENE	BMDL	5.00				
120-82-1	1,2,4-TRICHLOROBENZENE	BMDL	2.50				
95-95-4	2,4,5-TRICHLOROPHENOL	BMDL	1.00				
88-06-2	2,4,6-TRICHLOROPHENOL	BMDL	1.00				
1582-09-8	TRIFLURALIN	BMDL	1.50				

BMDL = BELOW METHOD DETECTION LIMIT
ACTUAL METHOD DETECTION LIMIT = DILUTION FACTOR x MDL

LYLE A. JOHNSON - Chemist

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	TP-5/TRAIN. CNT.	EPA:	# FL095
SAMPLE NUMBER	003-041291	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/12/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/11/91	GEORGIA:	# 828
SAMPLE TYPE	SOIL	SOUTH CAROLINA:	# 96015
SUBMITTER	DIRECT EXPRESS		

TEST		RESULTS	
LEAD,T	3050/7421	15.0	MG/KG D.W.
ARSENIC,T	3050/7060	.40	MG/KG D.W.
BARIUM,T	3050/7080	<5.0	MG/KG D.W.
CADMIUM,T	3050/7131	.20	MG/KG D.W.
CHROMIUM,T	3050/7191	3.5	MG/KG D.W.
SELENIUM,T	3050/7740	.30	MG/KG D.W.
MERCURY,T	7471	<0.1	MG/KG D.W.
SILVER,T	3050/7760	<0.1	MG/KG D.W.
EPA 8240		POSITIVE	
EPA 8270		POSITIVE	
pH OF SOLID	9045	7.1	

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE
SAMPLE: 003-041291/ TP-5 TRAIN. CNT. #219
DATA FILE: >41616::D4
DATE REPORTED: 4/17/91 3:25
DILUTION FACT: 5.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8240
PURGEABLE ORGANICS - SOILS -

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
67-64-1	ACETONE	0.0	5.00
75-05-8	ACETONITRILE	0.0	10.0
107-02-8	ACROLEIN	0.0	80.0
107-13-1	ACRYLONITRILE	0.0	20.0
71-43-2	BENZENE	0.0	1.00
100-44-7	BENZYL CHLORIDE	0.0	1.00
75-27-4	BROMODICHLOROMETHANE	0.0	1.00
75-25-2	BROMOFORM	0.0	1.00
74-83-9	BROMOMETHANE	0.0	5.00
78-93-3	2-BUTANONE (MEK)	0.0	10.0
75-15-0	CARBON DISULFIDE	0.0	5.00
56-23-53	CARBON TETRACHLORIDE	0.0	1.00
108-90-7	CHLOROBENZENE	0.0	1.00
124-48-1	CHLORODIBROMOMETHANE	0.0	1.00
75-00-3	CHLOROETHANE	0.0	5.00
110-75-8	2-CHLOROETHYLVINYLETHER	0.0	5.00
67-66-3	CHLOROFORM	0.0	1.00
74-87-3	CHLOROMETHANE	0.0	1.00
96-12-8	1,2-DIBROMO-3-CHLOROPRO	0.0	1.00
106-93-4	1,2-DIBROMOETHANE	0.0	1.00
74-95-3	DIBROMOMETHANE	0.0	1.00
764-41-0	1,4-DICHLORO-2-BUTENE	0.0	5.00
75-71-8	DICHLORODIFLUOROMETHANE	0.0	5.00
75-34-3	1,1-DICHLOROETHANE	0.0	1.00
107-06-2	1,2-DICHLOROETHANE	0.0	1.00
75-35-4	1,1-DICHLOROETHENE	0.0	1.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/
95-50-1	o-DICHLOROBENZENE	0.0	1.0
541-73-1	m-DICHLOROBENZENE	0.0	1.0
106-46-7	p-DICHLOROBENZENE	17.9	1.0
156-60-5	trans,1,2-DICHLOROETHENE	0.0	1.0
78-87-5	1,2-DICHLOROPROPANE	0.0	1.0
10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	1.0
10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	1.0
100-41-4	ETHYLBENZENE	0.0	1.0
591-78-6	HEXANE	0.0	1.0
78-83-1	ISOBUTYL ALCOHOL	0.0	20.
75-09-2	METHYLENE CHLORIDE	0.0	5.0
108-10-1	4-METHYL-2-PENTANONE	0.0	10.
109-06-8	2-PICOLINE	0.0	
110-86-1	PYRIDINE	0.0	
100-42-5	STYRENE	0.0	...
630-20-6	1,1,1,2-TETRACHLOROETHANE	0.0	1.0
79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	1.0
127-18-4	TETRACHLOROETHENE	0.0	1.0
108-88-3	TOLUENE	0.0	1.0
71-55-6	1,1,1-TRICHLOROETHANE	0.0	1.0
79-00-5	1,1,2-TRICHLOROETHANE	0.0	1.0
79-01-6	TRICHLOROETHENE	0.0	1.0
75-69-4	TRICHLOROFLUOROMETHANE	0.0	5.0
96-18-4	1,2,3-TRICHLOROPROPANE	0.0	1.0
108-05-4	VINYL ACETATE	0.0	5.0
75-01-4	VINYL CHLORIDE	0.0	1.0
1330-20-7	TOTAL XYLENES	0.0	1.0

LYLE A. JOHNSON Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FA
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 003-041291/ TP-5 TRAIN CNT #219
DATA FILE: >4B12A::D3
DATE REPORTED: 4/17/91 3:54
DILUTION FACT: 100.0000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
83-32-9	ACENAPHTHENE	BMDL	0.50
208-96-8	ACENAPHTHYLENE	BMDL	0.50
98-86-2	ACETOPHENONE	BMDL	0.50
309-00-2	ALDRIN	BMDL	0.50
101-05-3	ANILAZINE	BMDL	10.0
62-53-3	ANILINE	BMDL	0.75
120-12-7	ANTHRACENE	BMDL	1.00
12674-11-2	AROCHLOR-1016	BMDL	5.00
11104-28-2	AROCHLOR-1221	BMDL	5.00
11141-16-5	AROCHLOR-1232	BMDL	5.00
53469-21-9	AROCHLOR-1242	BMDL	5.00
12672-29-6	AROCHLOR-1248	BMDL	5.00
11097-69-1	AROCHLOR-1254	BMDL	5.00
11096-82-5	AROCHLOR-1260	BMDL	5.00
86-50-0	AZINPHOS METHYL "GUTHION"	BMDL	5.00
101-27-9	BARBAN	BMDL	5.00
?-87-5	BENZIDINE	BMDL	20.0
.5-85-0	BENZOIC ACID	BMDL	25.0
56-55-3	BENZO(a)ANTHRACENE	BMDL	0.75
205-99-2	BENZO(b)FLUORANTHENE	BMDL	0.75
207-08-9	BENZO(k)FLUORANTHENE	BMDL	1.00
191-24-2	BENZO(ghi)PERYLENE	BMDL	0.85
50-32-8	BENZO(a)PYRENE	BMDL	1.00
106-51-4	p-BENZOQUINONE	BMDL	1.00
100-51-6	BENZYL ALCOHOL	BMDL	1.00
319-84-6	BHC-alpha	BMDL	1.00
319-85-7	BHC-beta	BMDL	1.00
319-86-8	BHC-delta	BMDL	1.00
58-89-9	BHC-gamma "LINDANE"	BMDL	1.00
111-91-1	BIS(2-CHLOROETHOXY)METHANE	BMDL	1.00
111-44-4	BIS(2-CHLOROETHYL)ETHER	BMDL	1.00
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	BMDL	1.00
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	BMDL	1.00
101-55-3	4-BROMODIPHENYLETHER	BMDL	0.50
1689-84-5	BROMOXYNIL	BMDL	5.00
85-68-7	BUTYLBENZYLPHTHALATE	BMDL	1.00
2425-06-1	CAPTAFOL	BMDL	5.00
133-06-2	CAPTAN	BMDL	2.50
63-25-2	CARBARYL	BMDL	1.00
1563-66-2	CARBOFURAN	BMDL	1.00
786-19-6	CARBOPHENOTHION	BMDL	1.50
57-74-9	CHLORDANE	BMDL	5.00
470-90-6	CHLORFEVINPHOS	BMDL	1.00
106-47-8	4-CHLOROANILINE	BMDL	2.50
510-15-6	CHLOROBENZILATE	BMDL	1.00
59-50-7	4-CHLORO-3-METHYLPHENOL	BMDL	10.0
91-58-7	2-CHLORONAPHTHALENE	BMDL	1.00
95-57-8	2-CHLOROPHENOL	BMDL	1.00
7005-72-3	4-CHLORODIPHENYLETHER	BMDL	1.00
'8-01-9	CHRYSENE	BMDL	2.50
ɔ-72-4	COUMAPHOS	BMDL	2.50
7700-17-6	CROTOXYPHOS	BMDL	5.00
72-54-8	p'p'-DDD	BMDL	1.00
72-55-9	p'p'-DDE	BMDL	1.00
50-29-3	p'p'-DDT	BMDL	5.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/k
298-03-3	DEMETON-o	BMDL	1.00
126-75-0	DEMETON-s	BMDL	1.00
2303-16-4	cis-DIALLATE	BMDL	1.00
2303-16-4	trans-DIALLATE	BMDL	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	BMDL	1.00
132-64-9	DIBENZOFURAN	BMDL	1.00
84-74-2	DI-n-BUTYLPHTHALATE	BMDL	1.00
117-80-6	DICHLONE	BMDL	5.00
95-50-1	1,2-DICHLOROBENZENE	BMDL	1.00
541-73-1	1,3-DICHLOROBENZENE	BMDL	1.00
106-46-7	1,4-DICHLOROBENZENE	BMDL	1.00
91-94-1	3,3-DICHLOROBENZIDINE	BMDL	20.0
120-83-2	2,4-DICHLOROPHENOL	BMDL	20.0
62-73-7	DICHLORVOS	BMDL	5.00
141-66-2	DICROTOPHOS	BMDL	5.00
60-57-'	DIELDRIN	BMDL	2.50
84-66-_	DIETHYLPHTHALATE	BMDL	1.00
60-51-5	DIMETHOATE	BMDL	2.50
105-67-9	2,4-DIMETHYLPHENOL	BMDL	2.00
131-11-3	DIMETHYLPHTHALATE	BMDL	1.00
528-29-0	m-DINITROBENZENE	BMDL	10.0
534-52-1	4,6-DINITRO-2-METHYLPHENOL	BMDL	40.0
51-28-5	2,4-DINITROPHENOL	BMDL	10.0
121-14-2	2,4-DINITROTOLUENE	BMDL	10.0
606-20-2	2,6-DINITROTOLUENE	BMDL	10.0
88-85-7	DINOSEB	BMDL	5.00
122-39-4	DIPHENYLAMINE	BMDL	2.50
122-66-7	1,2-DIPHENYLHYDRAZINE	BMDL	5.00
117-84-0	DI-n-OCTYLPHTHALATE	BMDL	5.00
298-04-4	DISULFOTON	BMDL	1.00
959-98-8	ENDOSULFAN I	BMDL	5.00
33212-65-9	ENDOSULFAN II	BMDL	5.00
1031-07-8	ENDOSULFAN SULFATE	BMDL	5.00
72-20-8	ENDRIN	BMDL	5.00
	ENDRIN KETONE	BMDL	1.00
2104-64-5	EPN	BMDL	1.00
563-12-2	ETHION	BMDL	1.00
52-85-7	FAMPHUR	BMDL	1.00
55-38-9	FENTHION	BMDL	1.00
33245-39-5	FLUCHLORALIN	BMDL	1.00
86-73-7	FLUORENE	BMDL	1.00
76-44-8	HEPATACHLOR	BMDL	1.00
1024-57-3	HEPTACHLOR EPOXIDE	BMDL	1.00
118-74-1	HEXACHLOROBENZENE	BMDL	1.00
87-68-3	HEXACHLOROBUTADIENE	BMDL	1.00
77-47-4	HEXACHLOROCYCLOPENTADIENE	BMDL	1.00
67-72-1	HEXACHLOROETHANE	BMDL	1.00
123-31-9	HYDROQUINONE	BMDL	1.00
193-39-5	INDENO(1,2,3-cd)PYRENE	BMDL	1.00
465-73-6	ISODRIN	BMDL	1.00
78-59-1	ISOPHORONE	BMDL	1.00
143-50-0	KEPONE	BMDL	1.00
21609-90-5	LEPTOPHOS	BMDL	1.00
121-75-5	MALATHION	BMDL	1.00

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 003-041291/ TP-5 TRAIN CNT #219
DATA FILE: >4B12A::D3

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
72-43-5	METHOXYCHLOR-p'p'	BMDL	5.00
90-12-0	1-METHYLNAPHTHALENE	BMDL	1.00
91-57-6	2-METHYLNAPHTHALENE	BMDL	1.00
298-00-0	METHYL PARATHION	BMDL	1.00
95-48-7	2-METHYLPHENOL "o-CRESOL"	BMDL	5.00
108-39-4	3-METHYLPHENOL "m-CRESOL"	BMDL	5.00
106-44-5	4-METHYLPHENOL "p-CRESOL"	BMDL	5.00
7786-34-7	MEVINPHOS	BMDL	1.00
2385-85-5	MIREX	BMDL	5.00
6923-22-4	MONOCROTOPHOS	BMDL	5.00
300-76-5	NALED	BMDL	5.00
91-20-3	NAPHTHALENE	390	1.00
130-15-4	1,4-NAPHTHOQUINONE	BMDL	5.00
54-11-5	NICOTINE	BMDL	10.0
98-95-3	NITROBENZENE	BMDL	5.00
1836-75-5	NITROFEN	BMDL	5.00
88-75-5	2-NITROPHENOL	BMDL	5.00
100-02-7	4-NITROPHENOL	BMDL	5.00
62-75-9	n-NITROSODIMETHYLAMINE	BMDL	10.0
86-30-6	n-NITROSODIPHENYLAMINE	BMDL	10.0
621-64-7	n-NITROSODI-n-PROPYLAMINE	BMDL	10.0
56-38-2	PARATHION	BMDL	1.00
82-68-3	PENTACHLORONITROBENZENE	BMDL	1.00
87-86-5	PENTACHLOROPHENOL	BMDL	5.00
85-01-8	PHENANTHRENE	BMDL	1.00
108-95-2	PHENOL	BMDL	1.00
298-02-2	PHORATE	BMDL	1.00
732-11-6	PHOSMET	BMDL	1.00
13171-21-6	PHOSPHAMIDON	BMDL	5.00
109-06-8	2-PICOLINE	BMDL	10.0
23950-58-5	PRONAMIDE	BMDL	1.00
129-00-0	PYRENE	BMDL	1.00
110-86-1	PYRIDINE	BMDL	10.0
13071-79-9	TERBUFOS	BMDL	5.00
95-94-3	1,2,4,5-TETRACHLOROBENZENE	BMDL	1.00
961-11-5	TETRACHLORVINPHOS	BMDL	5.00
8001-35-2	TOXAPHENE	BMDL	5.00
120-82-1	1,2,4-TRICHLOROBENZENE	BMDL	2.50
95-95-4	2,4,5-TRICHLOROPHENOL	BMDL	1.00
88-06-2	2,4,6-TRICHLOROPHENOL	BMDL	1.00
1582-09-8	TRIFLURALIN	BMDL	1.50

MISCELLANEOUS ANALYTES

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
30560-19-1	ACEPHATE	BMDL	10.0
76-06-2	CHLORPICRIN	BMDL	5.00
2675-77-6	CHLORNEB	BMDL	1.00
5598-13-0	CHLORPYRIFOS "DURSBAN"	BMDL	1.00
99-30-9	DICHLORAN "BOTRAN"	BMDL	1.00
333-41-5	DIAZINON	BMDL	1.00
120-36-5	DICHLORPROP	BMDL	10.0
957-51-7	DIPHENAMID	BMDL	1.00
25311-71-1	ISOFENPHOS	BMDL	5.00
150-50-5	MERPHOS	BMDL	1.00
114-26-1	PROPUXUR	BMDL	5.00
206-44-0	FLUORANTHENE	BMDL	1.00

BMDL = BELOW METHOD DETECTION LIMIT
ACTUAL METHOD DETECTION LIMIT = DILUTION FACTOR x MDL

LYLE A. JOHNSON - Chemist

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	TP-8/TRAIN. CNT.	EPA:	# FLO95
SAMPLE NUMBER	004-041291	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/12/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/11/91	GEORGIA:	# 828
SAMPLE TYPE	SOIL	SOUTH CAROLINA:	# 96015
SUBMITTER	DIRECT EXPRESS		

TEST		RESULTS	
LEAD,T	3050/7421	3210.0	MG/KG D.W.
ARSENIC,T	3050/7060	2.10	MG/KG D.W.
BARIUM,T	3050/7080	41.	MG/KG D.W.
CADMIUM,T	3050/7131	3.10	MG/KG D.W.
CHROMIUM,T	3050/7191	49.0	MG/KG D.W.
SELENIUM,T	3050/7740	.30	MG/KG D.W.
MERCURY,T	7471	<0.1	MG/KG D.W.
SILVER,T	3050/7760	.3	MG/KG D.W.
EPA 8240		POSITIVE	
EPA 8270		POSITIVE	
pH OF SOLID	9045	7.4	

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE
SAMPLE: 004-041291/ TP-8 TRAIN. CNT. #219
DATA FILE: >41617::D4
DATE REPORTED: 4/17/91 4:25
DILUTION FACT: 5.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8240
PURGEABLE ORGANICS - SOILS -

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
67-64-1	ACETONE	0.0	5.00
75-05-8	ACETONITRILE	0.0	10.0
107-02-8	ACROLEIN	0.0	80.0
107-13-1	ACRYLONITRILE	0.0	20.0
71-43-2	BENZENE	0.0	1.00
100-44-7	BENZYL CHLORIDE	0.0	1.00
75-27-4	BROMODICHLOROMETHANE	0.0	1.00
75-25-2	BROMOFORM	0.0	1.00
74-83-9	BROMOMETHANE	0.0	5.00
78-93-3	2-BUTANONE (MEK)	0.0	10.0
75-15-0	CARBON DISULFIDE	0.0	5.00
56-23-53	CARBON TETRACHLORIDE	0.0	1.00
108-90-7	CHLOROBENZENE	154.0	1.00
124-48-1	CHLORODIBROMOMETHANE	0.0	1.00
75-00-3	CHLOROETHANE	0.0	5.00
110-75-8	2-CHLOROETHYLVINYLETHER	0.0	5.00
67-66-3	CHLOROFORM	0.0	1.00
74-87-3	CHLOROMETHANE	0.0	1.00
96-12-8	1,2-DIBROMO-3-CHLOROPRO	0.0	1.00
106-93-4	1,2-DIBROMOETHANE	0.0	1.00
74-95-3	DIBROMOMETHANE	0.0	1.00
764-41-0	1,4-DICHLORO-2-BUTENE	0.0	5.00
75-71-8	DICHLORODIFLUOROMETHANE	0.0	5.00
75-34-3	1,1-DICHLOROETHANE	0.0	1.00
107-06-2	1,2-DICHLOROETHANE	0.0	1.00
75-35-4	1,1-DICHLOROETHENE	0.0	1.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
95-50-1	o-DICHLOROBENZENE	23.3	1.00
541-73-1	m-DICHLOROBENZENE	0.0	1.00
106-46-7	p-DICHLOROBENZENE	97.0	1.00
156-60-5	trans,1,2-DICHLOROETHENE	0.0	1.00
78-87-5	1,2-DICHLOROPROPANE	0.0	1.00
10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	1.00
10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	1.00
100-41-4	ETHYLBENZENE	0.0	1.00
591-78-6	HEXANE	0.0	1.00
78-83-1	ISOBUTYL ALCOHOL	0.0	20.
75-09-2	METHYLENE CHLORIDE	0.0	5.00
108-10-1	4-METHYL-2-PENTANONE	0.0	10.
109-06-8	2-PICOLINE	0.0	
110-86-1	PYRIDINE	0.0	
100-42-5	STYRENE	0.0	1.00
630-20-6	1,1,1,2-TETRACHLOROETHANE	0.0	1.00
79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	1.00
127-18-4	TETRACHLOROETHENE	0.0	1.00
108-88-3	TOLUENE	0.0	1.00
71-55-6	1,1,1-TRICHLOROETHANE	0.0	1.00
79-00-5	1,1,2-TRICHLOROETHANE	0.0	1.00
79-01-6	TRICHLOROETHENE	0.0	1.00
75-69-4	TRICHLOROFLUOROMETHANE	0.0	5.00
96-18-4	1,2,3-TRICHLOROPROPANE	0.0	1.00
108-05-4	VINYL ACETATE	0.0	5.00
75-01-4	VINYL CHLORIDE	0.0	1.00
1330-20-7	TOTAL XYLENES	0.0	1.00

LYLE A. JOHNSON - Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FA
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 004-041291/ TP-8 TRAIN CNT #219
DATA FILE: >4B13A::D3
DATE REPORTED: 4/17/91 5:12
DILUTION FACT: 100.0000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
83-32-9	ACENAPHTHENE	160	0.50
208-96-8	ACENAPHTHYLENE	165	0.50
98-86-2	ACETOPHENONE	BMDL	0.50
309-00-2	ALDRIN	BMDL	0.50
101-05-3	ANILAZINE	BMDL	10.0
62-53-3	ANILINE	BMDL	0.75
120-12-7	ANTHRACENE	380	1.00
12674-11-2	AROCHLOR-1016	BMDL	5.00
11104-28-2	AROCHLOR-1221	BMDL	5.00
11141-16-5	AROCHLOR-1232	BMDL	5.00
53469-21-9	AROCHLOR-1242	BMDL	5.00
12672-29-6	AROCHLOR-1248	BMDL	5.00
11097-69-1	AROCHLOR-1254	BMDL	5.00
11096-82-5	AROCHLOR-1260	BMDL	5.00
86-50-0	AZINPHOS METHYL "GUTHION"	BMDL	5.00
01-27-9	BARBAN	BMDL	5.00
2-87-5	BENZIDINE	BMDL	20.0
65-85-0	BENZOIC ACID	BMDL	25.0
56-55-3	BENZO(a)ANTHRACENE	260	0.75
205-99-2	BENZO(b)FLUORANTHENE	470	0.75
207-08-9	BENZO(k)FLUORANTHENE	470	1.00
191-24-2	BENZO(ghi)PERYLENE	BMDL	0.85
50-32-8	BENZO(a)PYRENE	240	1.00
106-51-4	p-BENZOQUINONE	BMDL	1.00
100-51-6	BENZYL ALCOHOL	BMDL	1.00
319-84-6	BHC-alpha	BMDL	1.00
319-85-7	BHC-beta	BMDL	1.00
319-86-8	BHC-delta	BMDL	1.00
58-89-9	BHC-gamma "LINDANE"	BMDL	1.00
111-91-1	BIS(2-CHLOROETHOXY)METHANE	BMDL	1.00
111-44-4	BIS(2-CHLOROETHYL)ETHER	BMDL	1.00
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	BMDL	1.00
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	8690	1.00
101-55-3	4-BROMODIPHENYLETHER	BMDL	0.50
1689-84-5	BROMOXYNIL	BMDL	5.00
85-68-7	BUTYLBENZYLPHTHALATE	3330	1.00
2425-06-1	CAPTAFOL	BMDL	5.00
133-06-2	CAPTAN	BMDL	2.50
63-25-2	CARBARYL	BMDL	1.00
1563-66-2	CARBOFURAN	BMDL	1.00
786-19-6	CARBOPHENOTHION	BMDL	1.50
57-74-9	CHLORDANE	BMDL	5.00
470-90-6	CHLORFEVINPHOS	BMDL	1.00
106-47-8	4-CHLOROANILINE	BMDL	2.50
510-15-6	CHLOROBENZILATE	BMDL	1.00
59-50-7	4-CHLORO-3-METHYLPHENOL	BMDL	10.0
91-58-7	2-CHLORONAPHTHALENE	BMDL	1.00
95-57-8	2-CHLOROPHENOL	BMDL	1.00
005-72-3	4-CHLORODIPHENYLETHER	BMDL	1.00
18-01-9	CHRYSENE	420	2.50
56-72-4	COUMAPHOS	BMDL	2.50
7700-17-6	CROTOXYPHOS	BMDL	5.00
72-54-8	p'p'-DDD	BMDL	1.00
72-55-9	p'p'-DDE	BMDL	1.00
50-29-3	p'p'-DDT	BMDL	5.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
298-03-3	DEMETON-o	BMDL	1.00
126-75-0	DEMETON-s	BMDL	1.00
2303-16-4	cis-DIALLATE	BMDL	1.00
2303-16-4	trans-DIALLATE	BMDL	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	BMDL	1.00
132-64-9	DIBENZOFURAN	BMDL	1.00
84-74-2	DI-n-BUTYLPHTHALATE	BMDL	1.00
117-80-6	DICHLONE	BMDL	5.00
95-50-1	1,2-DICHLOROBENZENE	BMDL	1.00
541-73-1	1,3-DICHLOROBENZENE	BMDL	1.00
106-46-7	1,4-DICHLOROBENZENE	100	1.00
91-94-1	3,3-DICHLOROBENZIDINE	BMDL	20.0
120-83-2	2,4-DICHLOROPHENOL	BMDL	20.0
62-73-7	DICHLORVOS	BMDL	5.00
141-66-2	DICROTOPHOS	BMDL	5.00
60-57-1	DIELDRIN	BMDL	2.50
84-66-2	DIETHYLPHTHALATE	BMDL	1.00
60-51-5	DIMETHOATE	BMDL	2.50
105-67-9	2,4-DIMETHYLPHENOL	BMDL	2.00
131-11-3	DIMETHYLPHTHALATE	BMDL	1.00
528-29-0	m-DINITROBENZENE	BMDL	10.0
534-52-1	4,6-DINITRO-2-METHYLPHENOL	BMDL	40.0
51-28-5	2,4-DINITROPHENOL	BMDL	10.0
121-14-2	2,4-DINITROTOLUENE	BMDL	10.0
606-20-2	2,6-DINITROTOLUENE	BMDL	10.0
88-85-7	DINOSEB	BMDL	5.00
122-39-4	DIPHENYLAMINE	BMDL	2.50
122-66-7	1,2-DIPHENYLHYDRAZINE	BMDL	5.00
117-84-0	DI-n-OCTYLPHTHALATE	BMDL	5.00
298-04-4	DISULFOTON	BMDL	1.00
959-98-8	ENDOSULFAN I	BMDL	5.00
33212-65-9	ENDOSULFAN II	BMDL	5.00
1031-07-8	ENDOSULFAN SULFATE	BMDL	5.00
72-20-8	ENDRIN	BMDL	5.00
	ENDRIN KETONE	BMDL	1.00
2104-64-5	EPN	BMDL	1.00
563-12-2	ETHION	BMDL	1.00
52-85-7	FAMPHUR	BMDL	1.00
55-38-9	FENTHION	BMDL	1.00
33245-39-5	FLUCHLORALIN	BMDL	1.00
86-73-7	FLUORENE	210	1.00
76-44-8	HEPATACHLOR	BMDL	1.00
1024-57-3	HEPTACHLOR EPOXIDE	BMDL	1.00
118-74-1	HEXACHLOROBENZENE	BMDL	1.00
87-68-3	HEXACHLOROBUTADIENE	BMDL	1.00
77-47-4	HEXACHLOROCYCLOPENTADIENE	BMDL	1.00
67-72-1	HEXACHLOROETHANE	BMDL	1.00
123-31-9	HYDROQUINONE	BMDL	1.00
193-39-5	INDENO(1,2,3-cd)PYRENE	BMDL	1.00
465-73-6	ISODRIN	BMDL	1.00
78-59-1	ISOPHORONE	BMDL	1.00
143-50-0	KEPONE	BMDL	1.00
21609-90-5	LEPTOPHOS	BMDL	1.00
121-75-5	MALATHION	[illegible]	[illegible]

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 004-041291/ TP-8 TRAIN CNT #219
DATA FILE: >4B13A::D3

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
72-43-5	METHOXYCHLOR-p'p'	BMDL	5.00
90-12-0	1-METHYLNAPHTHALENE	330	1.00
91-57-6	2-METHYLNAPHTHALENE	630	1.00
298-00-0	METHYL PARATHION	BMDL	1.00
95-48-7	2-METHYLPHENOL "o-CRESOL"	BMDL	5.00
108-39-4	3-METHYLPHENOL "m-CRESOL"	BMDL	5.00
106-44-5	4-METHYLPHENOL "p-CRESOL"	BMDL	5.00
7786-34-7	MEVINPHOS	BMDL	1.00
2385-85-5	MIREX	BMDL	5.00
6923-22-4	MONOCROTOPHOS	BMDL	5.00
300-76-5	NALED	BMDL	5.00
91-20-3	NAPHTHALENE	580	1.00
130-15-4	1,4-NAPHTHOQUINONE	BMDL	5.00
54-11-5	NICOTINE	BMDL	10.0
98-95-3	NITROBENZENE	BMDL	5.00
1836-75-5	NITROFEN	BMDL	5.00
88-75-5	2-NITROPHENOL	BMDL	5.00
100-02-7	4-NITROPHENOL	BMDL	5.00
62-75-9	n-NITROSODIMETHYLAMINE	BMDL	10.0
86-30-6	n-NITROSODIPHENYLAMINE	BMDL	10.0
621-64-7	n-NITROSODI-n-PROPYLAMINE	BMDL	10.0
56-38-2	PARATHION	BMDL	1.00
82-68-3	PENTACHLORONITROBENZENE	BMDL	1.00
87-86-5	PENTACHLOROPHENOL	BMDL	5.00
85-01-8	PHENANTHRENE	1800	1.00
108-95-2	PHENOL	BMDL	1.00
298-02-2	PHORATE	BMDL	1.00
732-11-6	PHOSMET	BMDL	1.00
13171-21-6	PHOSPHAMIDON	BMDL	5.00
109-06-8	2-PICOLINE	BMDL	10.0
23950-58-5	PRONAMIDE	BMDL	1.00
129-00-0	PYRENE	1290	1.00
110-86-1	PYRIDINE	BMDL	10.0
13071-79-9	TERBUFOS	BMDL	5.00
95-94-3	1,2,4,5-TETRACHLOROBENZENE	BMDL	1.00
961-11-5	TETRACHLORVINPHOS	BMDL	5.00
8001-35-2	TOXAPHENE	BMDL	5.00
120-82-1	1,2,4-TRICHLOROBENZENE	BMDL	2.50
95-95-4	2,4,5-TRICHLOROPHENOL	BMDL	1.00
88-06-2	2,4,6-TRICHLOROPHENOL	BMDL	1.00
1582-09-8	TRIFLURALIN	BMDL	1.50

MISCELLANEOUS ANALYTES

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/k
30560-19-1	ACEPHATE	BMDL	10.0
76-06-2	CHLORPICRIN	BMDL	5.00
2675-77-6	CHLORNEB	BMDL	1.00
5598-13-0	CHLORPYRIFOS "DURSBAN"	BMDL	1.00
99-30-9	DICHLORAN "BOTRAN"	BMDL	1.00
333-41-5	DIAZINON	BMDL	1.00
120-36-5	DICHLORPROP	BMDL	10.0
957-51-7	DIPHENAMID	BMDL	1.00
25311-71-1	ISOFENPHOS	BMDL	5.00
150-50-5	MERPHOS	BMDL	1.00
114-26-1	PROPUXUR	BMDL	5.00
206-44-0	FLUORANTHENE	1920	1.00

BMDL = BELOW METHOD DETECTION LIMIT
ACTUAL METHOD DETECTION LIMIT = DILUTION FACTOR x MDL

LYCE A. JOHNSON - Chemist

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	TP-2A//TRAIN CNTR	EPA:	# FL095
SAMPLE NUMBER	005-041291	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/12/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/11/91	GEORGIA:	# 828
SAMPLE TYPE	SOIL	SOUTH CAROLINA:	# 96015
SUBMITTER	DIRECT EXPRESS		

TEST		RESULTS	
LEAD,T	3050/7421	22.0	MG/KG D.W.
ARSENIC,T	3050/7060	11.00	MG/KG D.W.
BARIUM,T	3050/7080	110.	MG/KG D.W.
CADMIUM,T	3050/7131	.30	MG/KG D.W.
CHROMIUM,T	3050/7191	15.0	MG/KG D.W.
SELENIUM,T	3050/7740	.40	MG/KG D.W.
MERCURY,T	7471	<0.1	MG/KG D.W.
SILVER,T	3050/7760	<0.1	MG/KG D.W.
EPA 8240		POSITIVE	
EPA 8270		POSITIVE	
pH OF SOLID	9045	7.5	

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE
SAMPLE: 005-041291/ TP-2A TRAIN. CNT. #21
DATA FILE: >41618::D4
DATE REPORTED: 4/17/91 5:27
DILUTION FACT: 5.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8240
PURGEABLE ORGANICS - SOILS -

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)	CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
67-64-1	ACETONE	0.0	5.00	95-50-1	o-DICHLOROBENZENE	0.0	1.00
75-05-8	ACETONITRILE	0.0	10.0	541-73-1	m-DICHLOROBENZENE	0.0	1.00
107-02-8	ACROLEIN	0.0	80.0	106-46-7	p-DICHLOROBENZENE	0.0	1.00
107-13-1	ACRYLONITRILE	0.0	20.0	156-60-5	trans,1,2-DICHLOROETHENE	0.0	1.00
71-43-2	BENZENE	0.0	1.00	78-87-5	1,2-DICHLOROPROPANE	0.0	1.00
100-44-7	BENZYL CHLORIDE	0.0	1.00	10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	1.00
75-27-4	BROMODICHLOROMETHANE	0.0	1.00	10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	1.00
75-25-2	BROMOFORM	0.0	1.00	100-41-4	ETHYLBENZENE	0.0	1.00
74-83-9	BROMOMETHANE	0.0	5.00	591-78-6	HEXANE	0.0	1.00
78-93-3	2-BUTANONE (MEK)	0.0	10.0	78-83-1	ISOBUTYL ALCOHOL	0.0	20.0
75-15-0	CARBON DISULFIDE	0.0	5.00	75-09-2	METHYLENE CHLORIDE	0.0	5.00
56-23-53	CARBON TETRACHLORIDE	0.0	1.00	108-10-1	4-METHYL-2-PENTANONE	0.0	10.0
108-90-7	CHLOROBENZENE	0.0	1.00	109-06-8	2-PICOLINE	0.0	[illegible]
124-48-1	CHLORODIBROMOMETHANE	0.0	1.00	110-86-1	PYRIDINE	0.0	[illegible]
75-00-3	CHLOROETHANE	0.0	5.00	100-42-5	STYRENE	0.0	[illegible]
110-75-8	2-CHLOROETHYLVINYLETHER	0.0	5.00	630-20-6	1,1,1,2-TETRACHLOROETHANE	0.0	1.00
67-66-3	CHLOROFORM	0.0	1.00	79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	1.00
74-87-3	CHLOROMETHANE	0.0	1.00	127-18-4	TETRACHLOROETHENE	0.0	1.00
96-12-8	1,2-DIBROMO-3-CHLOROPRO	0.0	1.00	108-88-3	TOLUENE	0.0	1.00
106-93-4	1,2-DIBROMOETHANE	0.0	1.00	71-55-6	1,1,1-TRICHLOROETHANE	0.0	1.00
74-95-3	DIBROMOMETHANE	0.0	1.00	79-00-5	1,1,2-TRICHLOROETHANE	0.0	1.00
764-41-0	1,4-DICHLORO-2-BUTENE	0.0	5.00	79-01-6	TRICHLOROETHENE	0.0	1.00
75-71-8	DICHLORODIFLUOROMETHANE	0.0	5.00	75-69-4	TRICHLOROFLUOROMETHANE	0.0	5.00
75-34-3	1,1-DICHLOROETHANE	0.0	1.00	96-18-4	1,2,3-TRICHLOROPROPANE	0.0	1.00
107-06-2	1,2-DICHLOROETHANE	0.0	1.00	108-05-4	VINYL ACETATE	0.0	5.00
75-35-4	1,1-DICHLOROETHENE	0.0	1.00	75-01-4	VINYL CHLORIDE	0.0	1.00
				1330-20-7	TOTAL XYLENES	6.3	1.00

LYLE A. JOHNSON Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FAC
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 005-041291/ TP-2A TRAIN CNT #219
DATA FILE: >4B14A::D3
DATE REPORTED: 4/17/91 6:35
DILUTION FACT: 100.0000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
83-32-9	ACENAPHTHENE	BMDL	0.50
208-96-8	ACENAPHTHYLENE	BMDL	0.50
98-86-2	ACETOPHENONE	BMDL	0.50
309-00-2	ALDRIN	BMDL	0.50
101-05-3	ANILAZINE	BMDL	10.0
62-53-3	ANILINE	BMDL	0.75
120-12-7	ANTHRACENE	100	1.00
12674-11-2	AROCHLOR-1016	BMDL	5.00
11104-28-2	AROCHLOR-1221	BMDL	5.00
11141-16-5	AROCHLOR-1232	BMDL	5.00
53469-21-9	AROCHLOR-1242	BMDL	5.00
12672-29-6	AROCHLOR-1248	BMDL	5.00
11097-69-1	AROCHLOR-1254	BMDL	5.00
11096-82-5	AROCHLOR-1260	BMDL	5.00
86-50-0	AZINPHOS METHYL "GUTHION"	BMDL	5.00
01-27-9	BARBAN	BMDL	5.00
2-87-5	BENZIDINE	BMDL	20.0
65-85-0	BENZOIC ACID	BMDL	25.0
56-55-3	BENZO(a)ANTHRACENE	230	0.75
205-99-2	BENZO(b)FLUORANTHENE	BMDL	0.75
207-08-9	BENZO(k)FLUORANTHENE	BMDL	1.00
191-24-2	BENZO(ghi)PERYLENE	BMDL	0.85
50-32-8	BENZO(a)PYRENE	BMDL	1.00
106-51-4	p-BENZOQUINONE	BMDL	1.00
100-51-6	BENZYL ALCOHOL	BMDL	1.00
319-84-6	BHC-alpha	BMDL	1.00
319-85-7	BHC-beta	BMDL	1.00
319-86-8	BHC-delta	BMDL	1.00
58-89-9	BHC-gamma "LINDANE"	BMDL	1.00
111-91-1	BIS(2-CHLOROETHOXY)METHANE	BMDL	1.00
111-44-4	BIS(2-CHLOROETHYL)ETHER	BMDL	1.00
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	BMDL	1.00
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	630	1.00
101-55-3	4-BROMODIPHENYLETHER	BMDL	0.50
1689-84-5	BROMOXYNIL	BMDL	5.00
85-68-7	BUTYLBENZYLPHTHALATE	5130	1.00
2425-06-1	CAPTAFOL	BMDL	5.00
133-06-2	CAPTAN	BMDL	2.50
63-25-2	CARBARYL	BMDL	1.00
1563-66-2	CARBOFURAN	BMDL	1.00
786-19-6	CARBOPHENOTHION	BMDL	1.50
57-74-9	CHLORDANE	BMDL	5.00
470-90-6	CHLORFEVINPHOS	BMDL	1.00
106-47-8	4-CHLOROANILINE	BMDL	2.50
510-15-6	CHLOROBENZILATE	BMDL	1.00
59-50-7	4-CHLORO-3-METHYLPHENOL	BMDL	10.0
91-58-7	2-CHLORONAPHTHALENE	BMDL	1.00
95-57-8	2-CHLOROPHENOL	BMDL	1.00
7005-72-3	4-CHLORODIPHENYLETHER	BMDL	1.00
18-01-9	CHRYSENE	120	2.50
56-72-4	COUMAPHOS	BMDL	2.50
7700-17-6	CROTOXYPHOS	BMDL	5.00
72-54-8	p'p'-DDD	BMDL	1.00
72-55-9	p'p'-DDE	BMDL	1.00
50-29-3	p'p'-DDT	BMDL	5.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
298-03-3	DEMETON-o	BMDL	1.00
126-75-0	DEMETON-s	BMDL	1.00
2303-16-4	cis-DIALLATE	BMDL	1.00
2303-16-4	trans-DIALLATE	BMDL	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	BMDL	1.00
132-64-9	DIBENZOFURAN	BMDL	1.00
84-74-2	DI-n-BUTYLPHTHALATE	BMDL	1.00
117-80-6	DICHLONE	BMDL	5.00
95-50-1	1,2-DICHLOROBENZENE	BMDL	1.00
541-73-1	1,3-DICHLOROBENZENE	BMDL	1.00
106-46-7	1,4-DICHLOROBENZENE	BMDL	1.00
91-94-1	3,3-DICHLOROBENZIDINE	BMDL	20.0
120-83-2	2,4-DICHLOROPHENOL	BMDL	20.0
62-73-7	DICHLORVOS	BMDL	5.00
141-66-2	DICROTOPHOS	BMDL	5.00
60-57-1	DIELDRIN	BMDL	2.50
84-66-2	DIETHYLPHTHALATE	BMDL	1.00
60-51-5	DIMETHOATE	BMDL	2.50
105-67-9	2,4-DIMETHYLPHENOL	BMDL	2.00
131-11-3	DIMETHYLPHTHALATE	BMDL	1.00
528-29-0	m-DINITROBENZENE	BMDL	10.0
534-52-1	4,6-DINITRO-2-METHYLPHENOL	BMDL	40.0
51-28-5	2,4-DINITROPHENOL	BMDL	10.0
121-14-2	2,4-DINITROTOLUENE	BMDL	10.0
606-20-2	2,6-DINITROTOLUENE	BMDL	10.0
88-85-7	DINOSEB	BMDL	5.00
122-39-4	DIPHENYLAMINE	BMDL	2.50
122-66-7	1,2-DIPHENYLHYDRAZINE	BMDL	5.00
117-84-0	DI-n-OCTYLPHTHALATE	BMDL	5.00
298-04-4	DISULFOTON	BMDL	1.00
959-98-8	ENDOSULFAN I	BMDL	5.00
33212-65-9	ENDOSULFAN II	BMDL	5.00
1031-07-8	ENDOSULFAN SULFATE	BMDL	5.00
72-20-8	ENDRIN	BMDL	5.00
	ENDRIN KETONE	BMDL	1.00
2104-64-5	EPN	BMDL	1.00
563-12-2	ETHION	BMDL	1.00
52-85-7	FAMPHUR	BMDL	1.00
55-38-9	FENTHION	BMDL	1.00
33245-39-5	FLUCHLORALIN	BMDL	1.00
86-73-7	FLUORENE	BMDL	1.00
76-44-8	HEPATACHLOR	BMDL	1.00
1024-57-3	HEPTACHLOR EPOXIDE	BMDL	1.00
118-74-1	HEXACHLOROBENZENE	BMDL	1.00
87-68-3	HEXACHLOROBUTADIENE	BMDL	1.00
77-47-4	HEXACHLOROCYCLOPENTADIENE	BMDL	1.00
67-72-1	HEXACHLOROETHANE	BMDL	1.00
123-31-9	HYDROQUINONE	BMDL	1.00
193-39-5	INDENO(1,2,3-cd)PYRENE	BMDL	1.00
465-73-6	ISODRIN	BMDL	1.00
78-59-1	ISOPHORONE	BMDL	1.00
143-50-0	KEPONE	BMDL	1.00
21609-90-5	LEPTOPHOS	BMDL	1.00
121-75-5	MALATHION	[illegible]	[illegible]

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 005-041291/ TP-2A TRAIN CNT #219
DATA FILE: >4B14A::D3

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
72-43-5	METHOXYCHLOR-p'p'	BMDL	5.00
90-12-0	1-METHYLNAPHTHALENE	BMDL	1.00
91-57-6	2-METHYLNAPHTHALENE	BMDL	1.00
298-00-0	METHYL PARATHION	BMDL	1.00
95-48-7	2-METHYLPHENOL "o-CRESOL"	BMDL	5.00
108-39-4	3-METHYLPHENOL "m-CRESOL"	BMDL	5.00
106-44-5	4-METHYLPHENOL "p-CRESOL"	BMDL	5.00
7786-34-7	MEVINPHOS	BMDL	1.00
2385-85-5	MIREX	BMDL	5.00
6923-22-4	MONOCROTOPHOS	BMDL	5.00
300-76-5	NALED	BMDL	5.00
91-20-3	NAPHTHALENE	560	1.00
130-15-4	1,4-NAPHTHOQUINONE	BMDL	5.00
54-11-5	NICOTINE	BMDL	10.0
98-95-3	NITROBENZENE	BMDL	5.00
1836-75-5	NITROFEN	BMDL	5.00
88-75-5	2-NITROPHENOL	BMDL	5.00
100-02-7	4-NITROPHENOL	BMDL	5.00
62-75-9	n-NITROSODIMETHYLAMINE	BMDL	10.0
86-30-6	n-NITROSODIPHENYLAMINE	BMDL	10.0
621-64-7	n-NITROSODI-n-PROPYLAMINE	BMDL	10.0
56-38-2	PARATHION	BMDL	1.00
82-68-3	PENTACHLORONITROBENZENE	BMDL	1.00
87-86-5	PENTACHLOROPHENOL	BMDL	5.00
85-01-8	PHENANTHRENE	180	1.00
108-95-2	PHENOL	BMDL	1.00
298-02-2	PHORATE	BMDL	1.00
732-11-6	PHOSMET	BMDL	1.00
13171-21-6	PHOSPHAMIDON	BMDL	5.00
109-06-8	2-PICOLINE	BMDL	10.0
23950-58-5	PRONAMIDE	BMDL	1.00
129-00-0	PYRENE	430	1.00
110-86-1	PYRIDINE	BMDL	10.0
13071-79-9	TERBUFOS	BMDL	5.00
95-94-3	1,2,4,5-TETRACHLOROBENZENE	BMDL	1.00
961-11-5	TETRACHLORVINPHOS	BMDL	5.00
8001-35-2	TOXAPHENE	BMDL	5.00
120-82-1	1,2,4-TRICHLOROBENZENE	BMDL	2.50
95-95-4	2,4,5-TRICHLOROPHENOL	BMDL	1.00
88-06-2	2,4,6-TRICHLOROPHENOL	BMDL	1.00
1582-09-8	TRIFLURALIN	BMDL	1.50

MISCELLANEOUS ANALYTES

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/k
30560-19-1	ACEPHATE	BMDL	10.0
76-06-2	CHLORPICRIN	BMDL	5.00
2675-77-6	CHLORNEB	BMDL	1.00
5598-13-0	CHLORPYRIFOS "DURSBAN"	BMDL	1.00
99-30-9	DICHLORAN "BOTRAN"	BMDL	1.00
333-41-5	DIAZINON	BMDL	1.00
120-36-5	DICHLORPROP	BMDL	10.0
957-51-7	DIPHENAMID	BMDL	1.00
25311-71-1	ISOFENPHOS	BMDL	5.00
150-50-5	MERPHOS	BMDL	1.00
114-26-1	PROPUXUR	BMDL	5.00
206-44-0	FLUORANTHENE	550	1.00

BMDL = BELOW METHOD DETECTION LIMIT
ACTUAL METHOD DETECTION LIMIT = DILUTION FACTOR x MDL

LYLE A. JOHNSON - Chemist

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	TP-5A//TRAIN CNTR	EPA:	# FL095
SAMPLE NUMBER	006-041291	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/12/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/11/91	GEORGIA:	# 828
SAMPLE TYPE	SOIL	SOUTH CAROLINA:	# 96015
SUBMITTER	DIRECT EXPRESS		

TEST		RESULTS	
LEAD,T	3050/7421	10.0	MG/KG D.W.
ARSENIC,T	3050/7060	.60	MG/KG D.W.
BARIUM,T	3050/7080	37.	MG/KG D.W.
CADMIUM,T	3050/7131	<0.1	MG/KG D.W.
CHROMIUM,T	3050/7191	4.8	MG/KG D.W.
SELENIUM,T	3050/7740	.20	MG/KG D.W.
MERCURY,T	7471	<0.1	MG/KG D.W.
SILVER,T	3050/7760	<0.1	MG/KG D.W.
EPA 8240		NEGATIVE	
EPA 8270		POSITIVE	
pH OF SOLID	9045	7.6	

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE
SAMPLE: 006-041291/ TP-5A TRAIN. CNT. #21
DATA FILE: >41619::D4
DATE REPORTED: 4/17/91 6:22
DILUTION FACT: 5.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8240
PURGEABLE ORGANICS - SOILS -

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)	CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
67-64-1	ACETONE	0.0	5.00	95-50-1	o-DICHLOROBENZENE	0.0	1.00
75-05-8	ACETONITRILE	0.0	10.0	541-73-1	m-DICHLOROBENZENE	0.0	1.00
107-02-8	ACROLEIN	0.0	80.0	106-46-7	p-DICHLOROBENZENE	0.0	1.00
107-13-1	ACRYLONITRILE	0.0	20.0	156-60-5	trans,1,2-DICHLOROETHENE	0.0	1.00
71-43-2	BENZENE	0.0	1.00	78-87-5	1,2-DICHLOROPROPANE	0.0	1.00
100-44-7	BENZYL CHLORIDE	0.0	1.00	10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	1.00
75-27-4	BROMODICHLOROMETHANE	0.0	1.00	10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	1.00
75-25-2	BROMOFORM	0.0	1.00	100-41-4	ETHYLBENZENE	0.0	1.00
74-83-9	BROMOMETHANE	0.0	5.00	591-78-6	HEXANE	0.0	1.00
78-93-3	2-BUTANONE (MEK)	0.0	10.0	78-83-1	ISOBUTYL ALCOHOL	0.0	20.0
75-15-0	CARBON DISULFIDE	0.0	5.00	75-09-2	METHYLENE CHLORIDE	0.0	5.00
56-23-53	CARBON TETRACHLORIDE	0.0	1.00	108-10-1	4-METHYL-2-PENTANONE	0.0	10.0
108-90-7	CHLOROBENZENE	0.0	1.00	109-06-8	2-PICOLINE	0.0	[illegible]
124-48-1	CHLORODIBROMOMETHANE	0.0	1.00	110-86-1	PYRIDINE	0.0	[illegible]
75-00-3	CHLOROETHANE	0.0	5.00	100-42-5	STYRENE	0.0	1.00
110-75-8	2-CHLOROETHYLVINYLETHER	0.0	5.00	630-20-6	1,1,1,2-TETRACHLOROETHANE	0.0	1.00
67-66-3	CHLOROFORM	0.0	1.00	79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	1.00
74-87-3	CHLOROMETHANE	0.0	1.00	127-18-4	TETRACHLOROETHENE	0.0	1.00
96-12-8	1,2-DIBROMO-3-CHLOROPRO	0.0	1.00	108-88-3	TOLUENE	0.0	1.00
106-93-4	1,2-DIBROMOETHANE	0.0	1.00	71-55-6	1,1,1-TRICHLOROETHANE	0.0	1.00
74-95-3	DIBROMOMETHANE	0.0	1.00	79-00-5	1,1,2-TRICHLOROETHANE	0.0	1.00
764-41-0	1,4-DICHLORO-2-BUTENE	0.0	5.00	79-01-6	TRICHLOROETHENE	0.0	1.00
75-71-8	DICHLORODIFLUOROMETHANE	0.0	5.00	75-69-4	TRICHLOROFLUOROMETHANE	0.0	5.00
75-34-3	1,1-DICHLOROETHANE	0.0	1.00	96-18-4	1,2,3-TRICHLOROPROPANE	0.0	1.00
107-06-2	1,2-DICHLOROETHANE	0.0	1.00	108-05-4	VINYL ACETATE	0.0	5.00
75-35-4	1,1-DICHLOROETHENE	0.0	1.00	75-01-4	VINYL CHLORIDE	0.0	1.00
				1330-20-7	TOTAL XYLENES	0.0	1.00

LYLE A. JOHNSON Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACT.
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 006-041291/ TP-5A TRAIN CNT #219
DATA FILE: >4B15A::D3
DATE REPORTED: 4/17/91 7:52
DILUTION FACT: 100.0000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
83-32-9	ACENAPHTHENE	BMDL	0.50
208-96-8	ACENAPHTHYLENE	BMDL	0.50
98-86-2	ACETOPHENONE	BMDL	0.50
309-00-2	ALDRIN	BMDL	0.50
101-05-3	ANILAZINE	BMDL	10.0
62-53-3	ANILINE	BMDL	0.75
120-12-7	ANTHRACENE	BMDL	1.00
12674-11-2	AROCHLOR-1016	BMDL	5.00
11104-28-2	AROCHLOR-1221	BMDL	5.00
11141-16-5	AROCHLOR-1232	BMDL	5.00
53469-21-9	AROCHLOR-1242	BMDL	5.00
12672-29-6	AROCHLOR-1248	BMDL	5.00
11097-69-1	AROCHLOR-1254	BMDL	5.00
11096-82-5	AROCHLOR-1260	BMDL	5.00
86-50-0	AZINPHOS METHYL "GUTHION"	BMDL	5.00
'01-27-9	BARBAN	BMDL	5.00
2-87-5	BENZIDINE	BMDL	20.0
65-85-0	BENZOIC ACID	BMDL	25.0
56-55-3	BENZO(a)ANTHRACENE	BMDL	0.75
205-99-2	BENZO(b)FLUORANTHENE	BMDL	0.75
207-08-9	BENZO(k)FLUORANTHENE	BMDL	1.00
191-24-2	BENZO(ghi)PERYLENE	BMDL	0.85
50-32-8	BENZO(a)PYRENE	BMDL	1.00
106-51-4	p-BENZOQUINONE	BMDL	1.00
100-51-6	BENZYL ALCOHOL	BMDL	1.00
319-84-6	BHC-alpha	BMDL	1.00
319-85-7	BHC-beta	BMDL	1.00
319-86-8	BHC-delta	BMDL	1.00
58-89-9	BHC-gamma "LINDANE"	BMDL	1.00
111-91-1	BIS(2-CHLOROETHOXY)METHANE	BMDL	1.00
111-44-4	BIS(2-CHLOROETHYL)ETHER	BMDL	1.00
39638-32-9	BIS(2-CHLOROISOPROPYL)ETHER	BMDL	1.00
117-81-7	BIS(2-ETHYLHEXYL)PHTHALATE	BMDL	1.00
101-55-3	4-BROMODIPHENYLETHER	BMDL	0.50
1689-84-5	BROMOXYNIL	BMDL	5.00
85-68-7	BUTYLBENZYLPHTHALATE	2130	1.00
2425-06-1	CAPTAFOL	BMDL	5.00
133-06-2	CAPTAN	BMDL	2.50
63-25-2	CARBARYL	BMDL	1.00
1563-66-2	CARBOFURAN	BMDL	1.00
786-19-6	CARBOPHENOTHION	BMDL	1.50
57-74-9	CHLORDANE	BMDL	5.00
470-90-6	CHLORFEVINPHOS	BMDL	1.00
106-47-8	4-CHLOROANILINE	BMDL	2.50
510-15-6	CHLOROBENZILATE	BMDL	1.00
59-50-7	4-CHLORO-3-METHYLPHENOL	BMDL	10.0
91-58-7	2-CHLORONAPHTHALENE	BMDL	1.00
95-57-8	2-CHLOROPHENOL	BMDL	1.00
'005-72-3	4-CHLORODIPHENYLETHER	BMDL	1.00
18-01-9	CHRYSENE	BMDL	2.50
56-72-4	COUMAPHOS	BMDL	2.50
7700-17-6	CROTOXYPHOS	BMDL	5.00
72-54-8	p'p'-DDD	BMDL	1.00
72-55-9	p'p'-DDE	BMDL	1.00
50-29-3	p'p'-DDT	BMDL	5.00

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/k
298-03-3	DEMETON-o	BMDL	1.00
126-75-0	DEMETON-s	BMDL	1.00
2303-16-4	cis-DIALLATE	BMDL	1.00
2303-16-4	trans-DIALLATE	BMDL	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	BMDL	1.00
132-64-9	DIBENZOFURAN	BMDL	1.00
84-74-2	DI-n-BUTYLPHTHALATE	BMDL	1.00
117-80-6	DICHLONE	BMDL	5.00
95-50-1	1,2-DICHLOROBENZENE	BMDL	1.00
541-73-1	1,3-DICHLOROBENZENE	BMDL	1.00
106-46-7	1,4-DICHLOROBENZENE	BMDL	1.00
91-94-1	3,3-DICHLOROBENZIDINE	BMDL	20.0
120-83-2	2,4-DICHLOROPHENOL	BMDL	20.0
62-73-7	DICHLORVOS	BMDL	5.00
141-66-2	DICROTOPHOS	BMDL	5.00
60-57-1	DIELDRIN	BMDL	2.50
84-66-2	DIETHYLPHTHALATE	BMDL	1.00
60-51-5	DIMETHOATE	BMDL	2.50
105-67-9	2,4-DIMETHYLPHENOL	BMDL	2.00
131-11-3	DIMETHYLPHTHALATE	BMDL	1.00
528-29-0	m-DINITROBENZENE	BMDL	10.0
534-52-1	4,6-DINITRO-2-METHYLPHENOL	BMDL	40.0
51-28-5	2,4-DINITROPHENOL	BMDL	10.0
121-14-2	2,4-DINITROTOLUENE	BMDL	10.0
606-20-2	2,6-DINITROTOLUENE	BMDL	10.0
88-85-7	DINOSEB	BMDL	5.00
122-39-4	DIPHENYLAMINE	BMDL	2.50
122-66-7	1,2-DIPHENYLHYDRAZINE	BMDL	5.00
117-84-0	DI-n-OCTYLPHTHALATE	BMDL	5.00
298-04-4	DISULFOTON	BMDL	1.00
959-98-8	ENDOSULFAN I	BMDL	5.00
33212-65-9	ENDOSULFAN II	BMDL	5.00
1031-07-8	ENDOSULFAN SULFATE	BMDL	5.00
72-20-8	ENDRIN	BMDL	5.00
	ENDRIN KETONE	BMDL	1.00
2104-64-5	EPN	BMDL	1.00
563-12-2	ETHION	BMDL	1.00
52-85-7	FAMPHUR	BMDL	1.00
55-38-9	FENTHION	BMDL	1.00
33245-39-5	FLUCHLORALIN	BMDL	1.00
86-73-7	FLUORENE	BMDL	1.00
76-44-8	HEPATACHLOR	BMDL	1.00
1024-57-3	HEPTACHLOR EPOXIDE	BMDL	1.00
118-74-1	HEXACHLOROBENZENE	BMDL	1.00
87-68-3	HEXACHLOROBUTADIENE	BMDL	1.00
77-47-4	HEXACHLOROCYCLOPENTADIENE	BMDL	1.00
67-72-1	HEXACHLOROETHANE	BMDL	1.00
123-31-9	HYDROQUINONE	BMDL	1.00
193-39-5	INDENO(1,2,3-cd)PYRENE	BMDL	1.00
465-73-6	ISODRIN	BMDL	1.00
78-59-1	ISOPHORONE	BMDL	1.00
143-50-0	KEPONE	BMDL	1.00
21609-90-5	LEPTOPHOS	BMDL	1.00
121-75-5	MALATHION	BMDL	1.00

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 006-041291/ TP-5A TRAIN CNT #219
DATA FILE: >4B15A::D3

EPA METHOD 8270
BASE/NEUTRALS AND ACIDS

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
72-43-5	METHOXYCHLOR-p'p'	BMDL	5.00
90-12-0	1-METHYLNAPHTHALENE	380	1.00
91-57-6	2-METHYLNAPHTHALENE	560	1.00
298-00-0	METHYL PARATHION	BMDL	1.00
95-48-7	2-METHYLPHENOL "o-CRESOL"	BMDL	5.00
108-39-4	3-METHYLPHENOL "m-CRESOL"	BMDL	5.00
106-44-5	4-METHYLPHENOL "p-CRESOL"	BMDL	5.00
7786-34-7	MEVINPHOS	BMDL	1.00
2385-85-5	MIREX	BMDL	5.00
6923-22-4	MONOCROTOPHOS	BMDL	5.00
300-76-5	NALED	BMDL	5.00
91-20-3	NAPHTHALENE	720	1.00
130-15-4	1,4-NAPHTHOQUINONE	BMDL	5.00
54-11-5	NICOTINE	BMDL	10.0
98-95-3	NITROBENZENE	BMDL	5.00
1836-75-5	NITROFEN	BMDL	5.00
88-75-5	2-NITROPHENOL	BMDL	5.00
100-02-7	4-NITROPHENOL	BMDL	5.00
62-75-9	n-NITROSODIMETHYLAMINE	BMDL	10.0
86-30-6	n-NITROSODIPHENYLAMINE	BMDL	10.0
621-64-7	n-NITROSODI-n-PROPYLAMINE	BMDL	10.0
56-38-2	PARATHION	BMDL	1.00
82-68-3	PENTACHLORONITROBENZENE	BMDL	1.00
87-86-5	PENTACHLOROPHENOL	BMDL	5.00
85-01-8	PHENANTHRENE	BMDL	1.00
108-95-2	PHENOL	BMDL	1.00
298-02-2	PHORATE	BMDL	1.00
732-11-6	PHOSMET	BMDL	1.00
13171-21-6	PHOSPHAMIDON	BMDL	5.00
109-06-8	2-PICOLINE	BMDL	10.0
23950-58-5	PRONAMIDE	BMDL	1.00
129-00-0	PYRENE	BMDL	1.00
110-86-1	PYRIDINE	BMDL	10.0
13071-79-9	TERBUFOS	BMDL	5.00
95-94-3	1,2,4,5-TETRACHLOROBENZENE	BMDL	1.00
961-11-5	TETRACHLORVINPHOS	BMDL	5.00
8001-35-2	TOXAPHENE	BMDL	5.00
120-82-1	1,2,4-TRICHLOROBENZENE	BMDL	2.50
95-95-4	2,4,5-TRICHLOROPHENOL	BMDL	1.00
88-06-2	2,4,6-TRICHLOROPHENOL	BMDL	1.00
1582-09-8	TRIFLURALIN	BMDL	1.50

MISCELLANEOUS ANALYTES

CAS No.	PARAMETER	CONCENTRATION (ug/kg)	*MDL (ug/kg)
[illegible]9-1	ACEPHATE	BMDL	10.0
76-06-2	CHLORPICRIN	BMDL	5.00
2675-77-6	CHLORNEB	BMDL	1.00
5598-13-0	CHLORPYRIFOS "DURSBAN"	BMDL	1.00
99-30-9	DICHLORAN "BOTRAN"	BMDL	1.00
333-41-5	DIAZINON	BMDL	1.00
120-36-5	DICHLORPROP	BMDL	10.0
957-51-7	DIPHENAMID	BMDL	1.00
25311-71-1	ISOFENPHOS	BMDL	5.00
150-50-5	MERPHOS	BMDL	1.00
114-26-1	PROPUXUR	BMDL	5.00
206-44-0	FLUORANTHENE	BMDL	1.00

BMDL = BELOW METHOD DETECTION LIMIT
ACTUAL METHOD DETECTION LIMIT = DILUTION FACTOR x MDL

LYLE A. JOHNSON - Chemist

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	CSY-FMW #2/NAVAL	EPA:	# FL095
SAMPLE NUMBER	001-041591	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/15/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/12/91	GEORGIA:	# 828
SAMPLE TYPE	WATER	SOUTH CAROLINA:	# 96015
SUBMITTER	FEDEX		

TEST		RESULTS	
EPA 624		POSITIVE	
EPA 625		POSITIVE	
ARSENIC	SM 304	<0.002	MG/L
CADMIUM	SM 300 SERIES	<0.001	MG/L
CHROMIUM,T	SM 300 SERIES	<0.002	MG/L
COPPER	SM 300 SERIES	.030	MG/L
LEAD, T	SM 300 SERIES	.002	MG/L
MERCURY	SM 300 SERIES	<0.0002	MG/L
SELENIUM	SM 300 SERIES	.002	MG/L
SILVER	SM 300 SERIES	<0.002	MG/L
ZINC	SM 300 SERIES	.07	MG/L
ANTIMONY	SM 300 SERIES	.004	MG/L
BERYLLIUM	SM 300 SERIES	<0.002	MG/L
NICKEL	SM 300 SERIES	.06	MG/L
THALLIUM	SM 304	<0.002	MG/L

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

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Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

CLIENT: WESTINGHOUSE-ENVIRO.
SAMPLE: 001-041591/ CSY-FMW #2 NAVAL BASE
DATA FILE: >41505::D4
DATE ANALYZED: 4/15/91 20:08
DILUTION FACTOR: .20000

EPA METHOD 624 - PURGEABLE ORGANICS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
71-43-2	BENZENE	20.0	(0.20)
75-27-4	BROMODICHLOROMETHANE	0.0	(0.20)
75-25-2	BROMOFORM	0.0	(0.20)
74-83-9	BROMOMETHANE	0.0	(0.50)
56-23-5	CARBON TETRACHLORIDE	0.0	(0.50)
108-90-7	CHLOROBENZENE	13.6	(0.20)
75-00-3	CHLOROETHANE	0.0	(0.50)
67-66-3	CHLOROFORM	0.0	(0.20)
74-87-3	CHLOROMETHANE	0.0	(0.50)
124-48-1	DIBROMOCHLOROMETHANE	0.0	(0.20)
95-50-1	o-DICHLOROBENZENE	.3	(0.20)
541-73-1	m-DICHLOROBENZENE	0.0	(0.20)
106-46-7	p-DICHLOROBENZENE	7.5	(0.20)
75-34-3	1,1-DICHLOROETHANE	0.0	(0.25)
107-06-2	1,2-DICHLOROETHANE	0.0	(0.20)
75-35-4	1,1-DICHLOROETHENE	0.0	(0.40)
156-60-5	trans,1,2-DICHLOROETHENE	0.0	(0.25)
78-87-5	1,2-DICHLOROPROPANE	0.0	(0.40)
10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	(0.50)
10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	(0.50)
100-41-1	ETHYLBENZENE	2.7	(0.20)
75-09-2	DICHLOROMETHANE	0.0	(0.50)
79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	(0.24)
127-18-4	TETRACHLOROETHENE	0.0	(0.14)
108-88-3	TOLUENE	4.6	(0.20)
71-55-6	1,1,1-TRICHLOROETHANE	.8	(0.30)
79-00-5	1,1,2-TRICHLOROETHANE	0.0	(0.30)
79-01-6	TRICHLOROETHENE	.4	(0.20)
75-01-4	VINYL CHLORIDE	0.0	(0.17)

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
A value of 0.0 = BMDL (BELOW METHOD DETECTION LIMIT)

LYLE A. JOHNSON - Chemist

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 001-041591/ CSY-FMW #2 N NAVAL BASE
DATA FILE: >4B01A::D3
DATE REPORTED: 4/16/91 12:27
DILUTION FACT: 1.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 625
BASE/NEUTRALS AND ACIDS

BASE AND NEUTRALS EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
83-32-9	ACENAPHTHENE	1.3	0.50
208-96-8	ACENAPHTHYLENE	0.0	0.50
120-12-7	ANTHRACENE	0.0	1.00
309-00-2	ALDRIN	0.0	0.75
56-55-3	BENZO(a)ANTHRACENE	0.0	1.00
205-99-2	BENZO(b)FLUORANTHENE	0.0	1.25
207-08-9	BENZO(k)FLUORANTHENE	0.0	1.25
50-32-8	BENZO(a)PYRENE	0.0	2.00
191-24-2	BENZO(ghi)PERYLENE	0.0	2.50
85-68-7	BUTYLBENZYLPHTHALATE	0.0	0.86
319-85-7	BHC-beta	0.0	0.50
319-86-8	HCH-delta	0.0	3.6
111-44-4	BIS(2-CHLOROETHYL)ETHER	0.0	0.75
11-91-1	BIS(2-CHLOROETHOXY)METHANE	0.0	0.75
117-81-7	DI(2-ETHYLHEXYL)PHTHALATE	0.0	1.00
108-60-1	BIS(2-CHLOROISOPROPYL)ETHE	0.0	0.85
101-55-3	4-BROMODIPHENYLETHER	0.0	1.00
57-74-9	CHLORDANE	0.0	1.00
91-58-7	2-CHLORONAPHTHALENE	0.0	0.55
7005-72-3	4-CHLORODIPHENYLETHER	0.0	1.00
218-01-9	CHRYSENE	0.0	1.50
72-54-8	p'p'-DDD	0.0	1.00
72-55-9	p'p'-DDE	0.0	1.00
50-29-3	p'p'-DDT	0.0	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	0.0	5.7
84-74-2	DI-n-BUTYLPHTHALATE	0.0	1.00
541-73-1	1,3-DICHLOROBENZENE	0.0	0.50
95-50-1	1,2-DICHLOROBENZENE	0.0	0.50
106-46-7	1,4-DICHLOROBENZENE	7.2	0.75
60-57-1	DIELDRIN	0.0	1.25
84-66-2	DIETHYLPHTHALATE	0.0	0.75
131-11-3	DIMETHYLPHTHALATE	0.0	0.75
121-14-2	2,4 DINITROTOLUENE	0.0	2.50
606-20-6	2,6-DINITROTOLUENE	0.0	2.75
117-84-0	DI-n-OCTYLPHTHALATE	0.0	1.00
1031-07-8	ENDOSULFAN SULFATE	0.0	5.00
206-44-0	FLUORANTHENE	0.0	1.00
86-73-7	FLUORENE	0.0	0.50
76-44-8	HEPTACHLOR	0.0	0.80
1024-57-3	HEPTACHLOR EPOXIDE	0.0	1.00
118-74-1	HEXACHLOROBENZENE	0.0	1.00
87-68-3	HEXACHLOROBUTADIENE	0.0	1.00
67-72-1	HEXACHLOROETHANE	0.0	1.40
193-39-5	INDENO(1,2,3-cd)PYRENE	0.0	2.50
78-59-1	ISOPHORONE	0.0	0.85
91-20-3	NAPHTHALENE	2.2	0.50
8-95-3	NITROBENZENE	0.0	2.00
85-01-8	PHENANTHRENE	0.0	1.00
129-00-0	PYRENE	0.0	1.00
120-82-1	1,2,4-TRICHLOROBENZENE	0.0	1.00

POLYCHLORINATED BIPHENYLS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
12674-11-2	PCB-1016	BMDL**	30.0
11104-28-2	PCB-1221	BMDL**	30.0
11141-16-5	PCB-1232	BMDL**	30.0
53469-21-9	PCB-1242	BMDL**	30.0
12672-29-6	PCB-1248	BMDL**	30.0
11097-69-1	PCB-1254	BMDL**	30.0
11096-82-5	PCB-1260	BMDL**	30.0

ACID EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
59-50-7	4-CHLORO-3-METHYLPHENOL	0.0	3.00
95-57-8	2-CHLOROPHENOL	0.0	1.00
120-83-2	2,4-DICHLOROPHENOL	0.0	1.50
105-67-9	2,4-DIMETHYLPHENOL	0.0	2.50
51-28-5	2,4-DINITROPHENOL	0.0	40.0
534-52-1	2-METHYL-4,6-DINITROPHENOL	0.0	20.0
88-75-5	2-NITROPHENOL	0.0	3.00
100-02-7	4-NITROPHENOL	0.0	2.50
87-86-5	PENTACHLOROPHENOL	0.0	2.75
109-95-2	PHENOL	0.0	0.50
88-06-2	2,4,6-TRICHLOROPHENOL	0.0	1.00

ADDITIONAL EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
92-87-5	BENZIDINE	0.0	40.0
319-84-6	BHC-alpha	0.0	1.00
959-98-8	ENDOSULFAN I	0.0	10.0
33213-65-9	ENDOSULFAN II	0.0	10.0
72-20-8	ENDRIN	0.0	1.25
77-47-4	HEXACHLOROCYCLOPENTADIENE	0.0	2.50
86-30-6	n-NITROSODIPHENYLAMINE	0.0	1.50
62-75-6	n-NITROSODIMETHYLAMINE	0.0	10.0
91-94-1	3,3-DICHLOROBENZIDINE	0.0	20.0
	2-METHYLNAPHTHALENE	5.5	0.5

LYLE A. JOHNSON - Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	CSY-FMW #4/NAVAL	EPA:	# FL095
SAMPLE NUMBER	002-041591	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/15/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/12/91	GEORGIA:	# 828
SAMPLE TYPE	WATER	SOUTH CAROLINA:	# 96015
SUBMITTER	FEDEX		

TEST		RESULTS	
EPA 624		POSITIVE	
EPA 625		POSITIVE	
ARSENIC	SM 304	<0.002	MG/L
CADMIUM	SM 300 SERIES	<0.001	MG/L
CHROMIUM,T	SM 300 SERIES	<0.002	MG/L
COPPER	SM 300 SERIES	.020	MG/L
LEAD, T	SM 300 SERIES	<0.002	MG/L
MERCURY	SM 300 SERIES	<0.0002	MG/L
SELENIUM	SM 300 SERIES	.003	MG/L
SILVER	SM 300 SERIES	<0.002	MG/L
ZINC	SM 300 SERIES	.05	MG/L
ANTIMONY	SM 300 SERIES	.003	MG/L
BERYLLIUM	SM 300 SERIES	<0.002	MG/L
NICKEL	SM 300 SERIES	.05	MG/L
THALLIUM	SM 304	<0.002	MG/L

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

CLIENT: WESTINGHOUSE-ENVIRO.
SAMPLE: 002-041591/ CSY-FMW #4 NAVAL BASE
DATA FILE: >41506::D4
DATE ANALYZED: 4/15/91 20:08
DILUTION FACTOR: .20000

EPA METHOD 624 - PURGEABLE ORGANICS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
71-43-2	BENZENE	6.9	(0.20)
75-27-4	BROMODICHLOROMETHANE	0.0	(0.20)
75-25-2	BROMOFORM	0.0	(0.20)
74-83-9	BROMOMETHANE	0.0	(0.50)
56-23-5	CARBON TETRACHLORIDE	0.0	(0.50)
108-90-7	CHLOROBENZENE	9.6	(0.20)
75-00-3	CHLOROETHANE	0.0	(0.50)
67-66-3	CHLOROFORM	0.0	(0.20)
74-87-3	CHLOROMETHANE	0.0	(0.50)
24-48-1	DIBROMOCHLOROMETHANE	0.0	(0.20)
5-50-1	o-DICHLOROBENZENE	.4	(0.20)
541-73-1	m-DICHLOROBENZENE	0.0	(0.20)
106-46-7	p-DICHLOROBENZENE	4.8	(0.20)
75-34-3	1,1-DICHLOROETHANE	0.0	(0.25)
107-06-2	1,2-DICHLOROETHANE	0.0	(0.20)
75-35-4	1,1-DICHLOROETHENE	0.0	(0.40)
156-60-5	trans,1,2-DICHLOROETHENE	0.0	(0.25)
78-87-5	1,2-DICHLOROPROPANE	0.0	(0.40)
10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	(0.50)
10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	(0.50)
100-41-1	ETHYLBENZENE	0.0	(0.20)
75-09-2	DICHLOROMETHANE	0.0	(0.50)
79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	(0.24)
127-18-4	TETRACHLOROETHENE	0.0	(0.14)
108-88-3	TOLUENE	.9	(0.20)
71-55-6	1,1,1-TRICHLOROETHANE	.6	(0.30)
79-00-5	1,1,2-TRICHLOROETHANE	0.0	(0.30)
79-01-6	TRICHLOROETHENE	0.0	(0.20)
75-01-4	VINYL CHLORIDE	0.0	(0.17)

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
A value of 0.0 = BMDL (BELOW METHOD DETECTION LIMIT)

LYLE A. JOHNSON - Chemist

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 002-041591/ CSY-FMW #4 NAVAL BASE
DATA FILE: >4B02A::D3
DATE REPORTED: 4/16/91 13:55
DILUTION FACT: 1.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 625
BASE/NEUTRALS AND ACIDS

BASE AND NEUTRALS EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
83-32-9	ACENAPHTHENE	4.3	0.50
208-96-8	ACENAPHTHYLENE	0.0	0.50
120-12-7	ANTHRACENE	3.0	1.00
309-00-2	ALDRIN	0.0	0.75
56-55-3	BENZO(a)ANTHRACENE	0.0	1.00
205-99-2	BENZO(b)FLUORANTHENE	0.0	1.25
207-08-9	BENZO(k)FLUORANTHENE	0.0	1.25
50-32-8	BENZO(a)PYRENE	0.0	2.00
191-24-2	BENZO(ghi)PERYLENE	0.0	2.50
85-68-7	BUTYLBENZYLPHTHALATE	0.0	0.86
319-85-7	BHC-beta	0.0	0.50
319-86-8	HCH-delta	0.0	3.6
111-44-4	BIS(2-CHLOROETHYL)ETHER	0.0	0.75
111-91-1	BIS(2-CHLOROETHOXY)METHANE	0.0	0.75
117-81-7	DI(2-ETHYLHEXYL)PHTHALATE	0.0	1.00
108-60-1	BIS(2-CHLOROISOPROPYL)ETHE	0.0	0.85
101-55-3	4-BROMODIPHENYLETHER	0.0	1.00
57-74-9	CHLORDANE	0.0	1.00
91-58-7	2-CHLORONAPHTHALENE	0.0	0.55
7005-72-3	4-CHLORODIPHENYLETHER	0.0	1.00
218-01-9	CHRYSENE	0.0	1.50
72-54-8	p'p'-DDD	0.0	1.00
72-55-9	p'p'-DDE	0.0	1.00
50-29-3	p'p'-DDT	0.0	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	0.0	5.7
84-74-2	DI-n-BUTYLPHTHALATE	0.0	1.00
541-73-1	1,3-DICHLOROBENZENE	0.0	0.50
[illegible]50-1	1,2-DICHLOROBENZENE	0.0	0.50
[illegible]-46-7	1,4-DICHLOROBENZENE	4.5	0.75
60-57-1	DIELDRIN	0.0	1.25
84-66-2	DIETHYLPHTHALATE	0.0	0.75
131-11-3	DIMETHYLPHTHALATE	0.0	0.75
121-14-2	2,4 DINITROTOLUENE	0.0	2.50
606-20-6	2,6-DINITROTOLUENE	0.0	2.75
117-84-0	DI-n-OCTYLPHTHALATE	0.0	1.00
1031-07-8	ENDOSULFAN SULFATE	0.0	5.00
206-44-0	FLUORANTHENE	0.0	1.00
86-73-7	FLUORENE	2.2	0.50
76-44-8	HEPTACHLOR	0.0	0.80
1024-57-3	HEPTACHLOR EPOXIDE	0.0	1.00
118-74-1	HEXACHLOROBENZENE	0.0	1.00
87-68-3	HEXACHLOROBUTADIENE	0.0	1.00
67-72-1	HEXACHLOROETHANE	0.0	1.40
193-39-5	INDENO(1,2,3-cd)PYRENE	0.0	2.50
78-59-1	ISOPHORONE	0.0	0.85
91-20-3	NAPHTHALENE	1.2	0.50
98-95-3	NITROBENZENE	0.0	2.00
85-01-8	PHENANTHRENE	3.0	1.00
129-00-0	PYRENE	0.0	1.00
120-82-1	1,2,4-TRICHLOROBENZENE	0.0	1.00

POLYCHLORINATED BIPHENYLS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
12674-11-2	PCB-1016	BMDL**	30.0
11104-28-2	PCB-1221	BMDL**	30.0
11141-16-5	PCB-1232	BMDL**	30.0
53469-21-9	PCB-1242	BMDL**	30.0
12672-29-6	PCB-1248	BMDL**	30.0
11097-69-1	PCB-1254	BMDL**	30.0
11096-82-5	PCB-1260	BMDL**	30.0

ACID EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
59-50-7	4-CHLORO-3-METHYLPHENOL	0.0	
95-57-8	2-CHLOROPHENOL	0.0	[illegible]
120-83-2	2,4-DICHLOROPHENOL	0.0	1.50
105-67-9	2,4-DIMETHYLPHENOL	0.0	2.50
51-28-5	2,4-DINITROPHENOL	0.0	40.0
534-52-1	2-METHYL-4,6-DINITROPHENOL	0.0	20.0
88-75-5	2-NITROPHENOL	0.0	3.00
100-02-7	4-NITROPHENOL	0.0	2.50
87-86-5	PENTACHLOROPHENOL	0.0	2.75
109-95-2	PHENOL	0.0	0.50
88-06-2	2,4,6-TRICHLOROPHENOL	0.0	1.00

ADDITIONAL EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
92-87-5	BENZIDINE	0.0	40.0
319-84-6	BHC-alpha	0.0	1.00
959-98-8	ENDOSULFAN I	0.0	10.0
33213-65-9	ENDOSULFAN II	0.0	10.0
72-20-8	ENDRIN	0.0	1.25
77-47-4	HEXACHLOROCYCLOPENTADIENE	0.0	2.50
86-30-6	n-NITROSODIPHENYLAMINE	0.0	1.50
62-75-6	n-NITROSODIMETHYLAMINE	0.0	10.0
91-94-1	3,3-DICHLOROBENZIDINE	0.0	20.0
	2-METHYLNAPHTHALENE	3.9	0.5

LYLE A. JOHNSON - Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	CSY-FMW #3/NAVAL	EPA:	# FL095
SAMPLE NUMBER	003-041591	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/15/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/12/91	GEORGIA:	# 828
SAMPLE TYPE	WATER	SOUTH CAROLINA:	# 96015
SUBMITTER	FEDEX		

TEST		RESULTS	
EPA 624		POSITIVE	
EPA 625		NEGATIVE	
ARSENIC	SM 304	<0.002	MG/L
CADMIUM	SM 300 SERIES	<0.001	MG/L
CHROMIUM,T	SM 300 SERIES	<0.002	MG/L
COPPER	SM 300 SERIES	.020	MG/L
LEAD, T	SM 300 SERIES	<0.002	MG/L
MERCURY	SM 300 SERIES	<0.0002	MG/L
SELENIUM	SM 300 SERIES	<0.002	MG/L
SILVER	SM 300 SERIES	<0.002	MG/L
ZINC	SM 300 SERIES	.06	MG/L
ANTIMONY	SM 300 SERIES	<0.002	MG/L
BERYLLIUM	SM 300 SERIES	<0.002	MG/L
NICKEL	SM 300 SERIES	.04	MG/L
THALLIUM	SM 304	<0.002	MG/L

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

Donald S. McCorquodale

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

CLIENT: WESTINGHOUSE-ENVIRO.
SAMPLE: 003-041591/ CSY-FMW #3 NAVAL BASE
DATA FILE: >41507::D4
DATE ANALYZED: 4/15/91 20:08
DILUTION FACTOR: .20000

EPA METHOD 624 - PURGEABLE ORGANICS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
71-43-2	BENZENE	1.5	(0.20)
75-27-4	BROMODICHLOROMETHANE	0.0	(0.20)
75-25-2	BROMOFORM	0.0	(0.20)
74-83-9	BROMOMETHANE	0.0	(0.50)
56-23-5	CARBON TETRACHLORIDE	0.0	(0.50)
108-90-7	CHLOROBENZENE	7.5	(0.20)
75-00-3	CHLOROETHANE	0.0	(0.50)
67-66-3	CHLOROFORM	0.0	(0.20)
74-87-3	CHLOROMETHANE	0.0	(0.50)
4-48-1	DIBROMOCHLOROMETHANE	0.0	(0.20)
-50-1	o-DICHLOROBENZENE	0.0	(0.20)
541-73-1	m-DICHLOROBENZENE	0.0	(0.20)
106-46-7	p-DICHLOROBENZENE	1.1	(0.20)
75-34-3	1,1-DICHLOROETHANE	0.0	(0.25)
107-06-2	1,2-DICHLOROETHANE	0.0	(0.20)
75-35-4	1,1-DICHLOROETHENE	0.0	(0.40)
156-60-5	trans,1,2-DICHLOROETHENE	0.0	(0.25)
78-87-5	1,2-DICHLOROPROPANE	0.0	(0.40)
10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	(0.50)
10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	(0.50)
100-41-1	ETHYLBENZENE	0.0	(0.20)
75-09-2	DICHLOROMETHANE	0.0	(0.50)
79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	(0.24)
127-18-4	TETRACHLOROETHENE	0.0	(0.14)
108-88-3	TOLUENE	1.7	(0.20)
71-55-6	1,1,1-TRICHLOROETHANE	.6	(0.30)
79-00-5	1,1,2-TRICHLOROETHANE	0.0	(0.30)
79-01-6	TRICHLOROETHENE	0.0	(0.20)
75-01-4	VINYL CHLORIDE	0.0	(0.17)

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
A value of 0.0 = BMDL (BELOW METHOD DETECTION LIMIT)

LYLE A. JOHNSON - Chemist

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 003-041591/ CSY-FMW #3 NAVAL BASE
DATA FILE: >4B03A::D3
DATE REPORTED: 4/16/91 15:32
DILUTION FACT: 1.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 625
BASE/NEUTRALS AND ACIDS

BASE AND NEUTRALS EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
83-32-9	ACENAPHTHENE	0.0	0.50
208-96-8	ACENAPHTHYLENE	0.0	0.50
120-12-7	ANTHRACENE	0.0	1.00
309-00-2	ALDRIN	0.0	0.75
56-55-3	BENZO(a)ANTHRACENE	0.0	1.00
205-99-2	BENZO(b)FLUORANTHENE	0.0	1.25
207-08-9	BENZO(k)FLUORANTHENE	0.0	1.25
50-32-8	BENZO(a)PYRENE	0.0	2.00
191-24-2	BENZO(ghi)PERYLENE	0.0	2.50
85-68-7	BUTYLBENZYLPHTHALATE	0.0	0.86
319-85-7	BHC-beta	0.0	0.50
319-86-8	HCH-delta	0.0	3.6
11-44-4	BIS(2-CHLOROETHYL)ETHER	0.0	0.75
1-91-1	BIS(2-CHLOROETHOXY)METHANE	0.0	0.75
117-81-7	DI(2-ETHYLHEXYL)PHTHALATE	0.0	1.00
108-60-1	BIS(2-CHLOROISOPROPYL)ETHE	0.0	0.85
101-55-3	4-BROMODIPHENYLETHER	0.0	1.00
57-74-9	CHLORDANE	0.0	1.00
91-58-7	2-CHLORONAPHTHALENE	0.0	0.55
7005-72-3	4-CHLORODIPHENYLETHER	0.0	1.00
218-01-9	CHRYSENE	0.0	1.50
72-54-8	p'p'-DDD	0.0	1.00
72-55-9	p'p'-DDE	0.0	1.00
50-29-3	p'p'-DDT	0.0	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	0.0	5.7
84-74-2	DI-n-BUTYLPHTHALATE	0.0	1.00
541-73-1	1,3-DICHLOROBENZENE	0.0	0.50
95-50-1	1,2-DICHLOROBENZENE	0.0	0.50
106-46-7	1,4-DICHLOROBENZENE	0.0	0.75
60-57-1	DIELDRIN	0.0	1.25
84-66-2	DIETHYLPHTHALATE	0.0	0.75
131-11-3	DIMETHYLPHTHALATE	0.0	0.75
121-14-2	2,4 DINITROTOLUENE	0.0	2.50
606-20-6	2,6-DINITROTOLUENE	0.0	2.75
117-84-0	DI-n-OCTYLPHTHALATE	0.0	1.00
1031-07-8	ENDOSULFAN SULFATE	0.0	5.00
206-44-0	FLUORANTHENE	0.0	1.00
86-73-7	FLUORENE	0.0	0.50
76-44-8	HEPTACHLOR	0.0	0.80
1024-57-3	HEPTACHLOR EPOXIDE	0.0	1.00
118-74-1	HEXACHLOROBENZENE	0.0	1.00
87-68-3	HEXACHLOROBUTADIENE	0.0	1.00
67-72-1	HEXACHLOROETHANE	0.0	1.40
193-39-5	INDENO(1,2,3-cd)PYRENE	0.0	2.50
78-59-1	ISOPHORONE	0.0	0.85
1-20-3	NAPHTHALENE	0.0	0.50
-95-3	NITROBENZENE	0.0	2.00
d5-01-8	PHENANTHRENE	0.0	1.00
129-00-0	PYRENE	0.0	1.00
120-82-1	1,2,4-TRICHLOROBENZENE	0.0	1.00

POLYCHLORINATED BIPHENYLS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
12674-11-2	PCB-1016	BMDL**	30.0
11104-28-2	PCB-1221	BMDL**	30.0
11141-16-5	PCB-1232	BMDL**	30.0
53469-21-9	PCB-1242	BMDL**	30.0
12672-29-6	PCB-1248	BMDL**	30.0
11097-69-1	PCB-1254	BMDL**	30.0
11096-82-5	PCB-1260	BMDL**	30.0

ACID EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
59-50-7	4-CHLORO-3-METHYLPHENOL	0.0	3.00
95-57-8	2-CHLOROPHENOL	0.0	1.00
120-83-2	2,4-DICHLOROPHENOL	0.0	1.50
105-67-9	2,4-DIMETHYLPHENOL	0.0	2.50
51-28-5	2,4-DINITROPHENOL	0.0	40.0
534-52-1	2-METHYL-4,6-DINITROPHENOL	0.0	20.0
88-75-5	2-NITROPHENOL	0.0	3.00
100-02-7	4-NITROPHENOL	0.0	2.50
87-86-5	PENTACHLOROPHENOL	0.0	2.75
109-95-2	PHENOL	0.0	0.50
88-06-2	2,4,6-TRICHLOROPHENOL	0.0	1.00

ADDITIONAL EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
92-87-5	BENZIDINE	0.0	40.0
319-84-6	BHC-alpha	0.0	1.00
959-98-8	ENDOSULFAN I	0.0	10.0
33213-65-9	ENDOSULFAN II	0.0	10.0
72-20-8	ENDRIN	0.0	1.25
77-47-4	HEXACHLOROCYCLOPENTADIENE	0.0	2.50
86-30-6	n-NITROSODIPHENYLAMINE	0.0	1.50
62-75-6	n-NITROSODIMETHYLAMINE	0.0	10.0
91-94-1	3,3-DICHLOROBENZIDINE	0.0	20.0
	2-METHYLNAPHTHALENE	0.0	0.5

LYLE A. JOHNSON - Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT	WESTINGHOUSE	DATE REPORTED:	04/18/91
SAMPLE LOCATION	CSY-FMW #1/NAVAL	EPA:	# FLO95
SAMPLE NUMBER	004-041591	FL DRINKING WATER:	# 86144
DATE RECEIVED	04/15/91	FL ENVIRONMENTAL:	# E86006
DATE SAMPLED	04/12/91	GEORGIA:	# 828
SAMPLE TYPE	WATER	SOUTH CAROLINA:	# 96015
SUBMITTER	FEDEX		

TEST		RESULTS	
EPA 624		POSITIVE	
EPA 625		POSITIVE	
ARSENIC	SM 304	<0.002	MG/L
CADMIUM	SM 300 SERIES	<0.001	MG/L
CHROMIUM,T	SM 300 SERIES	<0.002	MG/L
COPPER	SM 300 SERIES	.040	MG/L
LEAD, T	SM 300 SERIES	<0.002	MG/L
MERCURY	SM 300 SERIES	<0.0002	MG/L
SELENIUM	SM 300 SERIES	<0.002	MG/L
SILVER	SM 300 SERIES	<0.002	MG/L
ZINC	SM 300 SERIES	.06	MG/L
ANTIMONY	SM 300 SERIES	.003	MG/L
BERYLLIUM	SM 300 SERIES	<0.002	MG/L
NICKEL	SM 300 SERIES	.04	MG/L
THALLIUM	SM 304	<0.002	MG/L

IF YOU HAVE ANY QUESTIONS PLEASE CONTACT ME.

DONALD S. MCCORQUODALE, JR. PH.D.
MICROBIOLOGIST

SPECTRUM
Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING WATER: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

CLIENT: WESTINGHOUSE-ENVIRO.
SAMPLE: 004-041591/ CSY-FMW #1 NAVAL BASE
DATA FILE: >41508::D4
DATE ANALYZED: 4/15/91 20:08
DILUTION FACTOR: .20000

EPA METHOD 624 - PURGEABLE ORGANICS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
71-43-2	BENZENE	1.9	(0.20)
75-27-4	BROMODICHLOROMETHANE	0.0	(0.20)
75-25-2	BROMOFORM	0.0	(0.20)
74-83-9	BROMOMETHANE	0.0	(0.50)
56-23-5	CARBON TETRACHLORIDE	0.0	(0.50)
108-90-7	CHLOROBENZENE	1.7	(0.20)
75-00-3	CHLOROETHANE	0.0	(0.50)
67-66-3	CHLOROFORM	0.0	(0.20)
74-87-3	CHLOROMETHANE	0.0	(0.50)
4-48-1	DIBROMOCHLOROMETHANE	0.0	(0.20)
5-50-1	o-DICHLOROBENZENE	0.0	(0.20)
541-73-1	m-DICHLOROBENZENE	0.0	(0.20)
106-46-7	p-DICHLOROBENZENE	.3	(0.20)
75-34-3	1,1-DICHLOROETHANE	0.0	(0.25)
107-06-2	1,2-DICHLOROETHANE	0.0	(0.20)
75-35-4	1,1-DICHLOROETHENE	0.0	(0.40)
156-60-5	trans,1,2-DICHLOROETHENE	0.0	(0.25)
78-87-5	1,2-DICHLOROPROPANE	0.0	(0.40)
10061-01-5	cis,1,3-DICHLOROPROPENE	0.0	(0.50)
10061-02-6	trans,1,3-DICHLOROPROPENE	0.0	(0.50)
100-41-1	ETHYLBENZENE	0.0	(0.20)
75-09-2	DICHLOROMETHANE	0.0	(0.50)
79-34-5	1,1,2,2-TETRACHLOROETHANE	0.0	(0.24)
127-18-4	TETRACHLOROETHENE	0.0	(0.14)
108-88-3	TOLUENE	2.2	(0.20)
71-55-6	1,1,1-TRICHLOROETHANE	0.0	(0.30)
79-00-5	1,1,2-TRICHLOROETHANE	0.0	(0.30)
79-01-6	TRICHLOROETHENE	0.0	(0.20)
75-01-4	VINYL CHLORIDE	0.0	(0.17)

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACTOR
A value of 0.0 = BMDL (BELOW METHOD DETECTION LIMIT)

LYLE A. JOHNSON - Chemist

SPECTRUM

Laboratories, Inc. FORT LAUDERDALE • SAVANNAH

CLIENT: WESTINGHOUSE ENVIRO.
SAMPLE: 004-041591/ CSY-FMW #1 NAVAL BASE
DATA FILE: >4B04A::D3
DATE REPORTED: 4/16/91 17:07
DILUTION FACT: 1.00000

-CERTIFICATIONS-
EPA: #FL095
FL DRINKING: #86144
FL ENVIRONMENTAL: #E86006
GA # 828
SC # 96015

EPA METHOD 625
BASE/NEUTRALS AND ACIDS

BASE AND NEUTRALS EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
83-32-9	ACENAPHTHENE	0.0	0.50
208-96-8	ACENAPHTHYLENE	0.0	0.50
120-12-7	ANTHRACENE	1.1	1.00
309-00-2	ALDRIN	0.0	0.75
56-55-3	BENZO(a)ANTHRACENE	0.0	1.00
205-99-2	BENZO(b)FLUORANTHENE	0.0	1.25
207-08-9	BENZO(k)FLUORANTHENE	0.0	1.25
50-32-8	BENZO(a)PYRENE	0.0	2.00
191-24-2	BENZO(ghi)PERYLENE	0.0	2.50
85-68-7	BUTYLBENZYLPHTHALATE	0.0	0.86
319-85-7	BHC-beta	0.0	0.50
319-86-8	HCH-delta	0.0	3.6
111-44-4	BIS(2-CHLOROETHYL)ETHER	0.0	0.75
11-91-1	BIS(2-CHLOROETHOXY)METHANE	0.0	0.75
117-81-7	DI(2-ETHYLHEXYL)PHTHALATE	0.0	1.00
108-60-1	BIS(2-CHLOROISOPROPYL)ETHE	0.0	0.85
101-55-3	4-BROMODIPHENYLETHER	0.0	1.00
57-74-9	CHLORDANE	0.0	1.00
91-58-7	2-CHLORONAPHTHALENE	0.0	0.55
7005-72-3	4-CHLORODIPHENYLETHER	0.0	1.00
218-01-9	CHRYSENE	0.0	1.50
72-54-8	p'p'-DDD	0.0	1.00
72-55-9	p'p'-DDE	0.0	1.00
50-29-3	p'p'-DDT	0.0	1.00
53-70-3	DIBENZO(ah)ANTHRACENE	0.0	5.7
84-74-2	DI-n-BUTYLPHTHALATE	0.0	1.00
541-73-1	1,3-DICHLOROBENZENE	0.0	0.50
95-50-1	1,2-DICHLOROBENZENE	0.0	0.50
106-46-7	1,4-DICHLOROBENZENE	0.0	0.75
60-57-1	DIELDRIN	0.0	1.25
84-66-2	DIETHYLPHTHALATE	0.0	0.75
131-11-3	DIMETHYLPHTHALATE	0.0	0.75
121-14-2	2,4 DINITROTOLUENE	0.0	2.50
606-20-6	2,6-DINITROTOLUENE	0.0	2.75
117-84-0	DI-n-OCTYLPHTHALATE	0.0	1.00
1031-07-8	ENDOSULFAN SULFATE	0.0	5.00
206-44-0	FLUORANTHENE	0.0	1.00
86-73-7	FLUORENE	0.0	0.50
76-44-8	HEPTACHLOR	0.0	0.80
1024-57-3	HEPTACHLOR EPOXIDE	0.0	1.00
118-74-1	HEXACHLOROBENZENE	0.0	1.00
87-68-3	HEXACHLOROBUTADIENE	0.0	1.00
67-72-1	HEXACHLOROETHANE	0.0	1.40
193-39-5	INDENO(1,2,3-cd)PYRENE	0.0	2.50
78-59-1	ISOPHORONE	0.0	0.85
-20-3	NAPHTHALENE	0.0	0.50
95-3	NITROBENZENE	0.0	2.00
85-01-8	PHENANTHRENE	1.1	1.00
129-00-0	PYRENE	0.0	1.00
120-82-1	1,2,4-TRICHLOROBENZENE	0.0	1.00

POLYCHLORINATED BIPHENYLS

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
12674-11-2	PCB-1016	BMDL**	30.0
11104-28-2	PCB-1221	BMDL**	30.0
11141-16-5	PCB-1232	BMDL**	30.0
53469-21-9	PCB-1242	BMDL**	30.0
12672-29-6	PCB-1248	BMDL**	30.0
11097-69-1	PCB-1254	BMDL**	30.0
11096-82-5	PCB-1260	BMDL**	30.0

ACID EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
59-50-7	4-CHLORO-3-METHYLPHENOL	0.0	[illegible]
95-57-8	2-CHLOROPHENOL	0.0	1.[illegible]
120-83-2	2,4-DICHLOROPHENOL	0.0	1.50
105-67-9	2,4-DIMETHYLPHENOL	0.0	2.50
51-28-5	2,4-DINITROPHENOL	0.0	40.0
534-52-1	2-METHYL-4,6-DINITROPHENOL	0.0	20.0
88-75-5	2-NITROPHENOL	0.0	3.00
100-02-7	4-NITROPHENOL	0.0	2.50
87-86-5	PENTACHLOROPHENOL	0.0	2.75
109-95-2	PHENOL	0.0	0.50
88-06-2	2,4,6-TRICHLOROPHENOL	0.0	1.00

ADDITIONAL EXTRACTABLES

CAS No.	PARAMETER	CONCENTRATION (ug/l)	*MDL (ug/l)
92-87-5	BENZIDINE	0.0	40.0
319-84-6	BHC-alpha	0.0	1.00
959-98-8	ENDOSULFAN I	0.0	10.0
33213-65-9	ENDOSULFAN II	0.0	10.0
72-20-8	ENDRIN	0.0	1.25
77-47-4	HEXACHLOROCYCLOPENTADIENE	0.0	2.50
86-30-6	n-NITROSODIPHENYLAMINE	0.0	1.50
62-75-6	n-NITROSODIMETHYLAMINE	0.0	10.0
91-94-1	3,3-DICHLOROBENZIDINE	0.0	20.0
	2-METHYLNAPHTHALENE	0.0	0.5

LYLE A. JOHNSON - Chemist

* ACTUAL DETECTION LIMIT = METHOD DETECTION LIMIT x DILUTION FACT
** BMDL - BELOW METHOD DETECTION LIMIT (A value of 0.0 = BMDL)

APPENDIX J

CAUSTIC POND - ANALYTICAL DATA

(Source: Reference 12)

GENERAL ENGINEERING LABORATORIES

Full Service Chemical Testing and Analysis

Office & Lab.
1313 Ashley River Road
Charleston, S.C.
Phone (803) 556-8171

Mailing Address
P.O. Box 30712
Charleston, S.C. 29407

Analysis Sheet

Client Geraghty & Miller, Inc.
P.O. Box 271173
Tampa, Florida 33688

Date August 4, 1981
P.O. No.
Requested by Mr. Phil Ciaravella

Sample Identification — Results

Analysis of Monitoring Wells
(July 28, 9181)

	CP-1	CP-2	CP-3	CP-4
ph	6.5	6.3	6.75	7.3
Conductivity, MMHOS/CM	3100	7400	1970	2700
Calcium, mg/L	250	490	192	101
Chloride, mg/L	670	1340	423	823
Sulfate, mg/L	279	552	116	124

By [signature]
George C. Greene, PhD

APPENDIX K

CHEMICAL DISPOSAL AREA - ANALYTICAL DATA

(Source: Reference 12)

ENERGY RESOURCES CO. INC

TRACE METAL ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller
Charleston, S.C.

mg/l unless otherwise stated

ERCO ID	CLIENT ID	F	NO^3	SO_4	TOC	COND umhos/cm
51-915a	CD-1	0.46	<0.01	26	110	27,000
51-916	CD-2	0.57	0.02	<1	110	32,000
51-917	CD-3	0.13	0.23	4	63	1,900
51-918	CD-4	0.71	<0.01	400	190	11,000
51-919	CD-5	0.69	<0.01	61	170	14,000

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID #.

Sample Rcvd. 7/30/81 Reported by

Date Analysis Completed 8/25/81 Checked by

ENERGY RESOURCES CO. INC

TRACE METAL ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller
Charleston, S.C.

ug/l unless otherwise stated

ERCO ID	CLIENT ID	Cd	Fe	Pb	Mg mg/l	Hg	Na mg/l
51-915a	CD-1	<1	200	<5	800	<0.1	5500
51-916	CD-2	<1	400	<5	820	<0.1	6300
51-917	CD-3	<1	46	<5	260	<0.1	2200
51-918	CD-4	<1	130	<5	280	<0.1	2500
51-919	CD-5	<1	1200	<5	280	<0.1	2800

If customer has any questions regarding analysis, refer to sample in question by its ERCO ID #.

Sample Rcvd. 7/30/81 Reported by nal

Date Analysis Completed 8/25/81 Checked by fala

pH MEASUREMENTS OF WATER SAMPLES
COLLECTED FROM MONITOR WELLS
AT THE CHEMICAL-DISPOSAL AREA[1]

Well Number	pH 7/27/81	pH 2/11/82
CD-1	6.85	7.22
CD-2	6.85	7.10
CD-3	7.45	8.63
CD-4	7.30	7.15
CD-5	7.30	6.68

[1] Measured at the time of sample collection.

ENERGY RESOURCES CO. INC.

INORGANIC CHEMISTRY LABORATORY

- Report of Chemical Analyses -

Client: Geraghty & Miller
Charleston, S.C.

ERCO ID	Client ID	Cl Concentration (gm/l)
51-915[a]	CD-1	7.3
51-916	CD-2	6.6
51-917	CD-3	0.2
51-918	CD-4	1.9
51-919	CD-5	2.7

Sample Rcvd. 7/30/81

Date Completed 8/25/81

Date of this rpt. 5/4/82

Reported by Kch

Checked by

Sample Rcvd: 2/12/82
Date Analysis Completed: 2/23/82
All Results In: μg/l (ppb)
Reported By: [signature]
Checked By: [signature]

Analyzed for: G & M SC Navy

ENERGY RESOURCES CO. INC.

VOLATILE ORGANICS ANALYSIS

- Report Sheet -

Compounds (in order of elution)	CD-1 13-1239	CD-2 13-1240	CD-3 13-1241	CD-4 13-1242	CD-5 13-1246
Vinyl chloride					
Methylene chloride	28	2000	7.5	1800	1500
1,1-dichloroethylene					
1,1-dichloroethane					
1,2-dichloroethylene					
Chloroform			1.5		
1,2-dichloroethane					
1,1,1-trichloroethane					
Carbon tetrachloride					
Bromodichloromethane					
Trichloroethylene					
Dibromochloromethane					
Bromoform					
Tetrachloroethylene					

Comments: All blank spaces are ND's (none detected).

D-5

Sample Rcvd: 7/30/81
Date Analysis Completed: 8/7/81
All Results In: mg/l
Reported By:
Checked By:

ENERGY RESOURCES CO. INC.

VOLATILE ORGANICS ANALYSIS

- Report Sheet -

Analyzed for: Geraghty & Miller

Compounds (in order of elution)	CD-1	CD-2	CD-3	CD-4	CD-5
Vinyl chloride					
Methylene chloride	0.58	0.32			
1,1-dichloroethylene					
1,1-dichloroethane					
trans-1,2-dichloroethylene					
1,2-dichloroethane					
1,1,1-trichloroethane					
1,2-Dichloropropane					
Trichloroethylene					
1,1,2-Trichloroethane					
Tetrachloroethylene					
Chlorobenzene			0.14		10.68
Unknown	0.20				

Comments: All blank spaces are ND's (none detected) (<0.05 mg/l, or 50 ppb)

ENERGY RESOURCES CO.,INC.

SUMMARY OF BASE/NEUTRAL PRIORITY POLLUTANTS

CLIENT: Geraghty & Miller

CLIENT I.D.: CD 1 DATE SAMPLE RECEIVED: 2/12/82

ERCO I.D.: 13-1239 DATE SAMPLE COMPLETED: 2/28/82

	BASE/NEUTRAL	ug/l
3	acenaphthene	ND
3	benzidine	ND
3	1,2,4-trichlorobenzene	ND
3	hexachlorobenzene	ND
12B	hexachloroethane	ND
3B	bis(2-chloroethyl)ether	ND
20B	2-chloronaphthalene	ND
5B	1,2-dichlorobenzene	ND
	1,3-dichlorobenzene	ND
	1,4-dichlorobenzene	ND
28B	3,3-dichlorobenzidine	ND
5B	2,4-dinitrotoluene	ND
36B	2,6-dinitrotoluene	ND
7B	1,2-diphenylhydrazine	ND
9B	fluoranthene	ND
0B	4-chlorophenyl phenyl ether	ND
1B	4-bromophenyl phenyl ether	ND
2B	bis(2-chloroisopropyl)ether	ND
3B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
3B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
5B	naphthalene	ND
56B	nitrobenzene	ND
	N-nitrosodimethylamine	ND
6	N-nitrosodiphenylamine	ND
3B	N-nitrosodi-n-propylamine	ND
66B	bis(2-ethylhexyl)phthalate	*
7B	butyl benzyl phthalate	ND

	BASE/NEUTRAL	ug
68B	di-n-butyl phthalate	N
69B	di-n-octyl phthalate	N
70B	diethyl phthalate	*
71B	dimethyl phthalate	N
72B	benzo(a)anthracene	N
73B	benzo(a)pyrene	N
74B	3,4-benzofluoranthene	N
75B	benzo(k)fluoranthene	N
76B	chrysene	N
77B	acenaphthylene	N
78B	anthracene	N
79B	benzo(ghi)perylene	N
80B	fluorene	N
81B	phenanthrene	N
82B	dibenzo(a,h)anthracene	N
83B	indeno(1,2,3-cd)pyrene	N
84B	pyrene	N
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	N

ND = Not Detected

NA = Not Applicable

* = 1-9 ug/l

Reported by: [signature]

Checked by: C. [signature]

ENERGY RESOURCES CO., INC.

SUMMARY OF BASE/NEUTRAL PRIORITY POLLUTANTS

CLIENT: Geraghty & Miller

CLIENT I.D.: CD 2 DATE SAMPLE RECEIVED: 2/12/82

ERCO I.D.: 13-1240 DATE SAMPLE COMPLETED: 2/28/82

	BASE/NEUTRAL	ug/l
3	acenaphthene	ND
2B	benzidine	ND
3	1,2,4-trichlorobenzene	ND
3	hexachlorobenzene	ND
12B	hexachloroethane	ND
3B	bis(2-chloroethyl)ether	ND
20B	2-chloronaphthalene	ND
5B	1,2-dichlorobenzene	ND
26B	1,3-dichlorobenzene	ND
	1,4-dichlorobenzene	ND
28B	3,3-dichlorobenzidine	ND
5B	2,4-dinitrotoluene	ND
36B	2,6-dinitrotoluene	ND
7B	1,2-diphenylhydrazine	ND
9B	fluoranthene	ND
0B	4-chlorophenyl phenyl ether	ND
1B	4-bromophenyl phenyl ether	ND
2B	bis(2-chloroisopropyl)ether	ND
3B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
3B	hexachlorocyclopentadiene	ND
54B	isophorone	ND
5B	naphthalene	ND
56B	nitrobenzene	ND
B	N-nitrosodimethylamine	ND
6	N-nitrosodiphenylamine	ND
3B	N-nitrosodi-n-propylamine	ND
6B	bis(2-ethylhexyl)phthalate	34
7B	butyl benzyl phthalate	ND

	BASE/NEUTRAL	ug
68B	di-n-butyl phthalate	N
69B	di-n-octyl phthalate	N
70B	diethyl phthalate	
71B	dimethyl phthalate	N
72B	benzo(a)anthracene	N
73B	benzo(a)pyrene	N
74B	3,4-benzofluoranthene	N
75B	benzo(k)fluoranthene	N
76B	chrysene	
77B	acenaphthylene	
78B	anthracene	N
79B	benzo(ghi)perylene	N
80B	fluorene	N
81B	phenanthrene	N
82B	dibenzo(a,h)anthracene	N
83B	indeno(1,2,3-cd)pyrene	N
84B	pyrene	N
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	N

ND = Not Detected

NA = Not Applicable

* = 1-9 ug/l

Reported by: NKY

Checked by: C. Lodge

ENERGY RESOURCES CO., INC.
SUMMARY OF BASE/NEUTRAL PRIORITY POLLUTANTS

IENT: Geraghty & Miller

IENT I.D.: CD 3 DATE SAMPLE RECEIVED: 2/12/82

CO I.D.: 13-1241 DATE SAMPLE COMPLETED: 2/28/82

BASE/NEUTRAL	ug/l
enaphthene	ND
zidine	ND
,4-trichlorobenzene	ND
achlorobenzene	ND
achloroethane	ND
(2-chloroethyl)ether	ND
hloronaphthalene	ND
-dichlorobenzene	ND
chlorobenzene	ND
-chlorobenzene	ND
-dichlorobenzidine	ND
-dinitrotoluene	ND
-dinitrotoluene	ND
-diphenylhydrazine	ND
oranthene	ND
hlorophenyl phenyl ether	ND
romophenyl phenyl ether	ND
(2-chloroisopropyl)ether	ND
(2-chloroethoxy)methane	ND
achlorobutadiene	ND
achlorocyclopentadiene	ND
horone	ND
thalene	*
obenzene	ND
sodimethylamine	ND
trosodiphenylamine	ND
trosodi-n-propylamine	ND
2-ethylhexyl)phthalate	*
l benzyl phthalate	ND

	BASE/NEUTRAL	ug/l
68B	di-n-butyl phthalate	*
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	*
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

ND = Not Detected

NA = Not Applicable

* = 1-9 ug/l

Reported by: NM

Checked by: C. Rlyer

ENERGY RESOURCES CO.,INC.
SUMMARY OF BASE/NEUTRAL PRIORITY POLLUTANTS

CLIENT: Geraghty & Miller

CLIENT I.D.: CD 4 DATE SAMPLE RECEIVED: 2/12/82

ERCO I.D.: 13-1242 DATE SAMPLE COMPLETED: 2/28/82

	BASE/NEUTRAL	ug/l
1B	acenaphthene	ND
B	benzidine	ND
3B	1,2,4-trichlorobenzene	ND
B	hexachlorobenzene	ND
12B	hexachloroethane	ND
8B	bis(2-chloroethyl)ether	ND
20B	2-chloronaphthalene	ND
5B	1,2-dichlorobenzene	ND
6B	1,3-dichlorobenzene	ND
7B	1,4-dichlorobenzene	ND
	3,3-dichlorobenzidine	ND
5B	2,4-dinitrotoluene	ND
6B	2,6-dinitrotoluene	ND
37B	1,2-diphenylhydrazine	ND
9B	fluoranthene	ND
40B	4-chlorophenyl phenyl ether	ND
1B	4-bromophenyl phenyl ether	ND
42B	bis(2-chloroisopropyl)ether	ND
3B	bis(2-chloroethoxy)methane	ND
52B	hexachlorobutadiene	ND
3B	hexachlorocyclopentadiene	ND
4B	isophorone	ND
5B	naphthalene	ND
6B	nitrobenzene	ND
1B	N-nitrosodimethylamine	ND
	N-nitrosodiphenylamine	ND
6	N-nitrosodi-n-propylamine	ND
6B	bis(2-ethylhexyl)phthalate	15
67B	butyl benzyl phthalate	ND

	BASE/NEUTRAL	u
68B	di-n-butyl phthalate	
69B	di-n-octyl phthalate	N
70B	diethyl phthalate	
71B	dimethyl phthalate	N
72B	benzo(a)anthracene	N
73B	benzo(a)pyrene	N
74B	3,4-benzofluoranthene	N
75B	benzo(k)fluoranthene	N
76B	chrysene	N
77B	acenaphthylene	
78B	anthracene	
79B	benzo(ghi)perylene	N
80B	fluorene	N
81B	phenanthrene	N
82B	dibenzo(a,h)anthracene	N
83B	indeno(1,2,3-cd)pyrene	N
84B	pyrene	N
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	N

ND = Not Detected
NA = Not Applicable
* = 1-9 ug/l

Reported by: MH

Checked by: C. Rodgers

ENERGY RESOURCES CO., INC.

SUMMARY OF BASE/NEUTRAL PRIORITY POLLUTANTS

IENT: Geraghty & Miller

IENT I.D.: CD 5 DATE SAMPLE RECEIVED: 2/12/82

CO I.D.: 13-1246 DATE SAMPLE COMPLETED: 2/28/82

BASE/NEUTRAL	ug/l
enaphthene	ND
nzidine	ND
2,4-trichlorobenzene	ND
xachlorobenzene	ND
xachloroethane	ND
s(2-chloroethyl)ether	ND
chloronaphthalene	ND
-dichlorobenzene	ND
chlorobenzene	ND
-chlorobenzene	ND
-dichlorobenzidine	ND
-dinitrotoluene	ND
-dinitrotoluene	ND
-diphenylhydrazine	ND
oranthene	ND
hlorophenyl phenyl ether	ND
romophenyl phenyl ether	ND
(2-chloroisopropyl)ether	ND
(2-chloroethoxy)methane	ND
achlorobutadiene	ND
achlorocyclopentadiene	ND
phorone	ND
nthalene	ND
robenzene	ND
sodimethylamine	ND
trosodiphenylamine	ND
trosodi-n-propylamine	ND
(2-ethylhexyl)phthalate	*
l benzyl phthalate	ND

	BASE/NEUTRAL	ug/
68B	di-n-butyl phthalate	*
69B	di-n-octyl phthalate	ND
70B	diethyl phthalate	*
71B	dimethyl phthalate	ND
72B	benzo(a)anthracene	ND
73B	benzo(a)pyrene	ND
74B	3,4-benzofluoranthene	ND
75B	benzo(k)fluoranthene	ND
76B	chrysene	ND
77B	acenaphthylene	ND
78B	anthracene	ND
79B	benzo(ghi)perylene	ND
80B	fluorene	ND
81B	phenanthrene	ND
82B	dibenzo(a,h)anthracene	ND
83B	indeno(1,2,3-cd)pyrene	ND
84B	pyrene	ND
129B	2,3,7,8-tetrachlorodibenzo-p-dioxin	ND

ND = Not Detected

NA = Not Applicable

* = 1-9 ug/l

Reported by: NHY

Checked by: C. Rodgers

APPENDIX L

ENVIRONMENTAL INCIDENT REPORTS

#87-99 AND #87-53-B PCB TRANSFORMER OIL SPILL

5090
Ser 461.3/463
13 AUG 1987

MEMORANDUM

From: Code 461.3
To: File
Via: (1) Code 460
(2) Code 461

Subj: ENVIRONMENTAL INCIDENT REPORT #87-53-B

Ref: (a) Environmental Incident Report #87-53 dtd 25 Jun 87
(b) Spill Report prepared by AmerEco dtd 22 Jun 87
(c) PHONCON AmerEco Steve Busch/CNSYD (Code 461.3) Sarah Morey of 7 Aug 87

Encl: (1) PCB Manifest Number 10138 dtd 29 Jun 87
(2) General Engineering Laboratories analytical dated 12 Aug 87

1. As shown in reference (a), twenty-two drums were filled with PCB oil contaminated soil and asphalt, samples taken as shown, and the spill site was covered with plastic sheeting by AmerEco employees. Analytical results from soil samples taken immediately after this initial cleanup, and analytical results from samples taken by AmerEco during site visit 15-17 June indicated that additional cleanup was necessary. (It is noted that the spill report, reference (b), contains several discrepancies concerning circumstances of this spill).

2. On 29 June AmerEco arranged further cleanup and removed 45,600 lbs of soil from the spill site, enclosure (1). AmerEco took samples, again splitting them with CNSYD. The spill site was again covered by AmerEco employees using 12' 2 x 4s to form a peaked cover. Analytical results indicated need for additional cleanup at five sampling points.

3. On 5 August AmerEco removed additional soil from contaminated sampling points and resampled these areas. The spill site was recovered with plastic sheeting. Samples were again split with CNSYD. Analytical results from this cleanup, enclosure (2), indicate <10 ppm PCB at all points sampled. Per reference (c), analytical by AmerEco indicate <11 ppm PCB as highest level found.

4. No further cleanup required. Spill site to be restored by AmerEco.

Sarah Morey
SARAH MOREY

Copy to:
461.3, 460 DF, PWD Circ

5090
Ser 461.22/585
21 OCT 1987

MEMORANDUM

From: Code 461.22
To: File
Via: (1) Code 460
(2) Code 461

Subj: ENVIRONMENTAL INCIDENT REPORT #87-88

Encl: (1) Spill message report
(2) Map of spill site
(3) General Engineering Laboratories lab analysis

1. Nature of incident: PCB transformer oil spill occurred when an insolator rod was broken.

2. Location of incident: Resource Recovery Facility, building 1278

3. When notified: Date: 14 Sep 87 Time: 0830

4. Notified by: Mark Epstein, Code 462.2

5. Immediate action taken: Shop 07 personnel applied absorbent to the spill area, which was approximately 25 square feet. The transformer was partially drained off and the oil collected in three 55 gallon drums. The area was secured with plastic covering and a boundry line, enclosure (1). The National Response Center was notified by Sarah Morey and a spill message report was sent in accordance with CNSYDINST 5090.1, enclosure (1). On September 16 the spill site was excuvated and the transformer was decontaminated by Shop 07 spill response team. Samples of the soil and wipes of the transformer and equipment used for cleanup were taken to General Engineering Laboratories for PCB analysis. Location of samples and wipes taken are indicated on enclosure (2).

6. Follow-up action taken or planned: The results of the wipes taken from the transformer and cleanup equipment indicated PCB contamination above the EPA limit of 10 micrograms per 100 centimeters squared, (10 ug/100cm^2). These results are shown on GEL Laboratory report sample ID numbers 147 and 148 enclosure (3). Additional deconning of the transformer was completed September 21 and the results of the analysis indicated satisfactory limits. Sample ID numbers 153, 154 and 155 list the satisfactory results enclosure (3). The final action planned is to dispose of PCB contaminated soil and oil through DRMO contractors and recover the site with asphalt.

Scott J Schafer
SCOTT SCHAFER

Copy to: COMNAVBASE (Code N4), 457, 460 DF, PWD Circ

JOINT MESSAGEFORM

UNCLASSIFIED

PAGE	DTG		PRECEDENCE	CLASS	SPECAT	LMF	CIC	ORIG MSG IDENT
01	161209Z	SEP 87	RR	UUUU				2591900

ADMIN

FM CHARLESTON NAVAL SHIPYARD

TO COMDT COGARD WASHINGTON DC

INFO CNO WASHINGTON

COMNAVFACENGCOM ALEXANDRIA VA

COMNAVSEASYSCOM WASHINGTON DC

EPA REGION IV

NAVENENUSA PORT HUENEME CA

UNCLAS//N05090//

SUBJ: HAZARDOUS SUBSTANCE RELEASE REPORT (REPORT SYMBOL OPNAV 5090-3)

1. CNO FOR OP-45 COMNAVFACENGCOM FOR 112

GMT DTG RELEASE OCCURRED 141300Z SEP 87

CHARLESTON NAVAL SHIPYARD, CHARLESTON, SC

4. BUILDING 1278, RESOURCE RECOVERY FACILITY

5. RESOURCE RECOVERY FACILITY

6. PCB TRANSFORMER, OUT OF SERVICE

7. PCB DIELECTRIC FLUID

8. NONE

9. 2 TO 6 GALLONS

10. A PALLET LOADED ON A FORKLIFT WAS JAMMED UP AGAINST AN INSULATOR. AS A RESULT OF THIS INCIDENT THE SEAL AROUND THE INSULATOR WAS CRACKED

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE

S. SCHAFER, ENGINEERING TECHNICIAN, CODE 461.22, X35519

SPECIAL INSTRUCTIONS

400/401|460|460 DF|PWD|CIRC|FXD|

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

B.L. RUNBERG, CAPT, PWO, 400, X33841

SIGNATURE

B L Runberg

SECURITY CLASSIFICATION

UNCLASSIFIED

DATE TIME GROUP

161209Z

DD FORM 173/2 (OCR)

U.S. GOVERNMENT PRINTING OFFICE

JOINT MESSAGEFORM

SECURITY CLASSIFICATION UNCLASSIFIED

PAGE	DTG RELEASER TIME			PRECEDENCE		CLASS	SPECAT	LMF	CIC	ORIG MSG IDENT
	DATE-TIME	MONTH	YR	ACT	INFO					
02 of 02	161209Z	SEP	87	RR		UUUU				2591900

MESSAGE HANDLING INSTRUCTIONS

ADMIN

CAUSING THE DIELECTRIC FLUID TO SPILL OUT.

11. THE DIELECTRIC FLUID SPILLED INTO A DRIP PAN AND ONTO THE ASPHALT COVERING AN AREA APPROXIMATELY 25 SQUARE FEET. THE SPILL WAS CONTAINED AND NO POTENTIAL DANGER OR DAMAGE TO THE IMMEDIATE AREA AND THE SURROUNDING ENVIRONMENT OCCURRED.

12. TELEPHONIC NOTIFICATIONS TO NRC, SCDHEC, COAST GUARD WERE MADE. NO ASSISTANCE REQUIRED.

13. SPILL WAS CONTAINED BY DRIP-PAN AND ABSORBENT. PUBLIC WORKS DEPARTMENT PERSONNEL CARRIED OUT CONTAINMENT ACTIONS.

14. CLEAN-UP ACTIONS WERE CARRIED OUT ON-SITE. TRANSFORMER WAS DECONTAMINATED AND THE AREA WILL BE EXCAVATED. THE EXCAVATED ASPHALT AND CONTAINMENT ABSORBENT WILL BE SHIPPED BY DRMO TO A PCB DISPOSAL SITE.

15. CONTACT FOR ADDITIONAL INFORMATION JOHN SNEED OR ALAN SHOULTZ, AUTOVON 563-5519.

DISTR:

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE

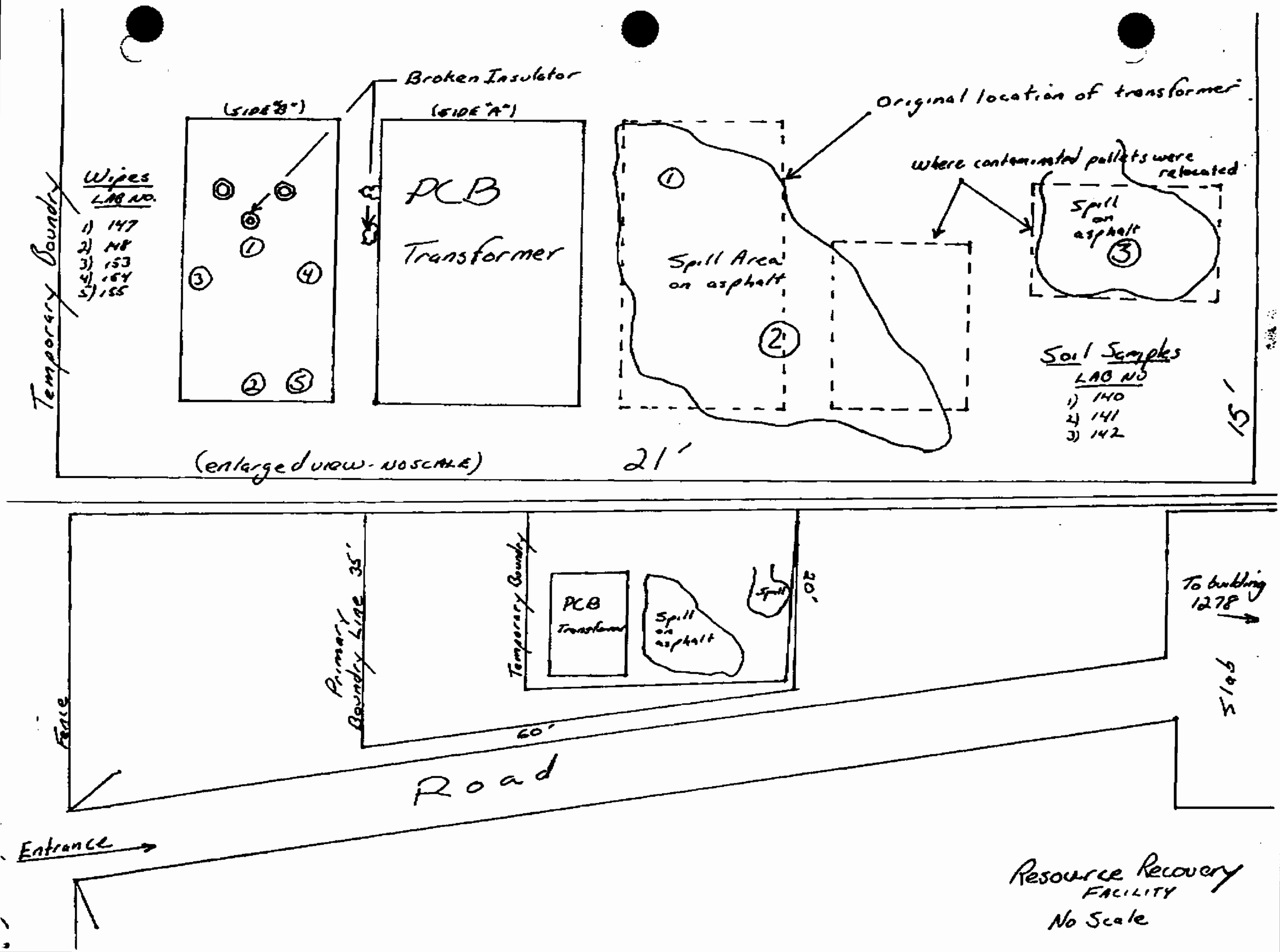
SPECIAL INSTRUCTIONS

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION UNCLASSIFIED

DATE TIME GROUP 161209Z



Broken Insulator
(SIDE "B")
(SIDE "A")
PCB Transformer
Original location of transformer
where contaminated pallets were relocated
Spill Area on asphalt
Spill on asphalt
Wipes
LAB NO.
1) 147
2) 148
3) 153
4) 154
5) 155
Soil Samples
LAB NO
1) 140
2) 141
3) 142
Temporary Boundry
(enlarged view - NO SCALE)
21'
15'
PCB Transformer
Spill on asphalt
Spill
Temporary Boundry
Primary Boundry Line 35'
20'
60'
Road
Fence
Entrance
To building 1278
S106
Resource Recovery FACILITY
No Scale

Engineering Consulting
Chemical Analysis

GENERAL ENGINEERING LABORATORIES
1313 Ashley River Road
Charleston, S.C. 29407
P.O. Box 30712
Charleston, S.C. 29417
Phone (803) 556-8171

Laboratory Certification Number 10120

CLIENT: CHARLESTON NAVAL SHIPYARD
BLDG.12, CODE 460
CHARLESTON , SC 29408
CONTACT: MR. SCOTT SCHAFER

CC/FC: NVBA/PCB1

DATE: 09/21/87

RELEASED BY: A. McCrane
for GEORGE C. GREENE PE,PHD
PAGE NO.: 1

PARAMETER	SAMPLE ID :	#140	#141	#142
	LAB ID :	87090835	87090836	87090837
	DATE RECEIVED:	09/17/87	09/17/87	09/17/87
AROCLOR 1016		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1221		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1232		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1242		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1248		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1254		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1260		<50 ppm	<50 ppm	<50 ppm
AROCLOR 1262		<50 ppm	<50 ppm	<50 ppm
EXTRACTION & CONCENTRATION		YES	YES	YES

GENERAL ENGINEERING LABORATORIES
1313 Ashley River Road
Charleston, S.C. 29407
P.O. Box 30712
Charleston, S.C. 29417
Phone (803) 556-8171
Engineering Consulting
Chemical Analysis

Laboratory Certification Number 10120

CLIENT: CHARLESTON NAVAL SHIPYARD
BLDG.12, CODE 460
CHARLESTON , SC 29408

DATE: 09/21/87

CONTACT: MR. SCOTT SCHAFER

RELEASED BY: G. C. Greene
GEORGE C. GREENE PE,PHD

CC/FC: NVBA/PCB2

PAGE NO.: 1

PARAMETER	SAMPLE ID :	#144	#145	#146	#147
	LAB ID :	87090839	87090840	87090841	87090842
	DATE RECEIVED:	09/17/87	09/17/87	09/17/87	09/17/87
AROCLOR 1016		<1*	<1*	<1*	<1*
AROCLOR 1221		<1	<1	<1	<1
AROCLOR 1232		<1	<1	<1	<1
AROCLOR 1242		<1	<1	<1	<1
AROCLOR 1248		1110	1350	120	1800
AROCLOR 1254		<1	<1	<1	<1
AROCLOR 1260		<1	<1	<1	<1
AROCLOR 1262		<1	<1	<1	<1
EXTRACTION & CONCENTRATION		YES	YES	YES	YES

* Micrograms per swab

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Phone (803) 556-8171
'ngineering Consulting
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Laboratory Certification Number 10120

CLIENT: CHARLESTON NAVAL SHIPYARD
BLDG.12, CODE 460
CHARLESTON , SC 29408
CONTACT: MR. SCOTT SCHAFER

DATE: 09/21/87

RELEASED BY: A M Crane
fr: GEORGE C. GREENE PE,PHD

CC/FC: NVBA/PCB2

PAGE NO.: 1

PARAMETER				
	SAMPLE ID :	#148	#149	#150
	LAB ID :	87090843	87090844	87090845
PARAMETER	DATE RECEIVED:	09/17/87	09/17/87	09/17/87
AROCLOR 1016		<1*	<1*	<1*
AROCLOR 1221		<1	<1	<1
AROCLOR 1232		<1	<1	<1
AROCLOR 1242		<1	<1	<1
AROCLOR 1248		765	<1	<1
AROCLOR 1254		<1	<1	<1
AROCLOR 1260		<1	<1	<1
AROCLOR 1262		<1	<1	<1
EXTRACTION & CONCENTRATION		YES	YES	YES

* Micrograms per swab

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Chemical Analysis

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Charleston, S.C. 29417
Phone (803) 556-8171

Laboratory Certification Number 10120

CLIENT: CHARLESTON NAVAL SHIPYARD
BLDG.12, CODE 460
CHARLESTON , SC 29408
CONTACT: MR. SCOTT SCHAFER

DATE: 09/23/87

RELEASED BY: for GEORGE C. GREENE PE,PHD

CC/FC: NVBA/PCB2

PAGE NO.: 1

PARAMETER	SAMPLE ID :	#151	#152	#153	#154
	LAB ID :	87091012	87091013	87091014	87091015
	DATE RECEIVED:	09/21/87	09/21/87	09/21/87	09/21/87
AROCLOR 1016		<1*	<1*	<1*	<1*
AROCLOR 1221		<1	<1	<1	<1
AROCLOR 1232		<1	<1	<1	<1
AROCLOR 1242		<1	<1	<1	<1
AROCLOR 1248		3	2	2	7
AROCLOR 1254		<1	<1	<1	<1
AROCLOR 1260		<1	<1	<1	<1
AROCLOR 1262		<1	<1	<1	<1
EXTRACTION & CONCENTRATION		YES	YES	YES	YES

*Micrograms per swab

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BLDG.12, CODE 460
CHARLESTON , SC 29408
CONTACT: MR. SCOTT SCHAFER

DATE: 09/23/87

RELEASED BY: [signature]
GEORGE C. GREENE PE,PHD
PAGE NO.: 1

CC/FC: NVBA/PCB2

PARAMETER		
SAMPLE ID :	#155	#156
LAB ID :	87091016	87091017
DATE RECEIVED:	09/21/87	09/21/87
AROCLOR 1016	<1 *	<1 *
AROCLOR 1221	<1	<1
AROCLOR 1232	<1	<1
AROCLOR 1242	<1	<1
AROCLOR 1248	16	<1
AROCLOR 1254	<1	<1
AROCLOR 1260	<1	<1
AROCLOR 1262	<1	<1
EXTRACTION & CONCENTRATION	YES	YES

* Micrograms per swab

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Chemical Analysis

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Charleston, S.C. 29417
Phone (803) 556-8171

oratory Certification Number 10120

CLIENT: CHARLESTON NAVAL SHIPYARD
BLDG.12, CODE 460
CHARLESTON , SC 29408

DATE: 08/12/87

CONTACT: MR. WAYNE H. NEVILLE

RELEASED BY: A.M. Crane
for: GEORGE C. GREENE PE,PHD

CC/FC: NVBA/PCB4

PAGE NO.: 1

PARAMETER					
	SAMPLE ID :	#102	#103	#104	#105
	LAB ID :	87080224	87080225	87080226	87080227
	DATE RECEIVED:	08/06/87	08/06/87	08/06/87	08/06/87
PCB ANALYSIS					
AROCLOR 1016		<10 ppm	<10 ppm	<10 ppm	<10 ppm
AROCLOR 1221		<10 ppm	<10 ppm	<10 ppm	<10 ppm
AROCLOR 1232		<10 ppm	<10 ppm	<10 ppm	<10 ppm
AROCLOR 1242		<10 ppm	<10 ppm	<10 ppm	<10 ppm
AROCLOR 1248		<10 ppm	<10 ppm	<10 ppm	<10 ppm
OCLOR 1254		<10 ppm	<10 ppm	<10 ppm	<10 ppm
1260		<10 ppm	<10 ppm	<10 ppm	<10 ppm
AROCLOR 1262		<10 ppm	<10 ppm	<10 ppm	<10 ppm
EXTRACTION & CONCENTRATION		YES	YES	YES	YES

ineering Consulting
mical Analysis

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P.O. Box 30712
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Phone (803) 556-8171

Laboratory Certification Number 10120

CLIENT: CHARLESTON NAVAL SHIPYARD
BLDG.12, CODE 460
CHARLESTON , SC 29408
CONTACT: MR. WAYNE H. NEVILLE

DATE: 08/12/87

RELEASED BY: A.M. Crane
for: GEORGE C. GREENE PE,PHD
PAGE NO.: 1

CC/FC: NVBA/PCB4

PARAMETER	SAMPLE ID : #106 LAB ID : 87080228 DATE RECEIVED: 08/06/87
PCB ANALYSIS	
AROCLOR 1016	<10 ppm
AROCLOR 1221	<10 ppm
AROCLOR 1232	<10 ppm
AROCLOR 1242	<10 ppm
AROCLOR 1248	<10 ppm
AROCLOR 1254	<10 ppm
AROCLOR 1260	<10 ppm
AROCLOR 1262	<10 ppm
EXTRACTION & CONCENTRATION	YES

APPENDIX M

OLD PLATING SHOP WASTE TREATMENT AREA - ANALYTICAL DATA

GENERAL ENGINEERING LABORATORIES

Environmental Engineering and Analytical Services

Molly L. Greene
President

George C. Greene, P.E., Ph.D.
Vice President
SC Registration No. 9103

Laboratory Certifications:

FL	E87156/8720
NC	23
SC	1012[illegible]
VA	0015[illegible]
NACIP	Approve[illegible]

CERTIFICATE OF ANALYSIS

Client: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

Date: 02/16/89

Contact: MR. J. SPEAKMAN, PhD, PE

Released by: ALLAN M. CRANE

cc/fc: ENSA/CR2

Page No.: 1

Parameter					
	Sample ID :	PW-1 (4') 02/06/89	PW-1 (5') 02/06/89	PW-1 (6') 02/06/89	PW-3 (4') 02/06/89
	Lab ID :	89020441	89020442	89020443	89020444
	Sample Type :	15	15	15	15
	Date Received:	02/06/89	02/06/89	02/06/89	02/06/89
	Collected by :	GEL	GEL	GEL	GEL
CHROMIUM		21.2 ppm	27.6 ppm	26.6 ppm	25.8 ppm
ACID DIGESTION		YES	YES	YES	YES

GENERAL ENGINEERING LABORATORIES

Environmental Engineering and Analytical Services

Molly [illegible]
President

George C. [illegible], P.E., Ph.D.
Vice President
SC Registration No. 9103

Laboratory Certifications:
[illegible] [illegible]
[illegible] 233
[illegible] 10120
[illegible] 00151
[illegible] Approved

CERTIFICATE OF ANALYSIS

Client: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

Date: 02/16/89

Contact: MR. J. SPEAKMAN, PhD, PE

Released by: [signature]
ALLAN M. CRANE

cc/fc: ENSA/ENSAM

Page No.: 1

Parameter					
	Sample ID :	PW-6 (4') 02/07/89	PW-6 (5') 02/07/89	PW-6 (6') 02/07/89	PW-13 (4') 02/07/89
	Lab ID :	89020534	89020535	89020536	89020537
	Sample Type :	15	15	15	15
	Date Received:	02/08/89	02/08/89	02/08/89	02/08/89
	Collected by :	GEL	GEL	GEL	GEL
CADMIUM					15.5 ppm
CHROMIUM		9.79 ppm	7.10 ppm	17.9 ppm	128 ppm
ACID DIGESTION		YES	YES	YES	YES

GENERAL ENGINEERING LABORATORIES

Environmental Engineering and Analytical Services

Molly L. Greene
President

George C. Greene, P.E., Ph.D.
Vice President
SC Registration No. 9101

Laboratory Certifications:
Approved

CERTIFICATE OF ANALYSIS

Client: ENVIRONMENTAL & SAFETY DESIGNS, INC
P.O. BOX 341315
MEMPHIS , TN 38184

Date: 02/16/89

Contact: MR. J. SPEAKMAN, PhD, PE

Released by:
ALLAN M. CRANE

cc/fc: ENSA/ENSAM

Page No.: 1

Parameter					
	Sample ID :	PW-14 (6') 02/07/89	PW-16 (4') 02/07/89	PW-16 (5') 02/07/89	PW-16 (6') 02/07/89
	Lab ID :	89020542	89020543	89020544	89020545
	Sample Type :	15	15	15	15
	Date Received:	02/08/89	02/08/89	02/08/89	02/08/89
	Collected by :	GEL	GEL	GEL	GEL
CADMIUM		0.596 ppm	3.36 ppm	2.31 ppm	1.32 ppm
ACID DIGESTION		YES	YES	YES	YES

2040 Savage Road • Charleston, SC 29414 / P. O. Box 30712 • Charleston, SC 29417

APPENDIX N

PRESSURE TREATED WASTE OIL LINE

MEMORANDUM: SEPT. 26, 1991

FROM: S. A. WASHINGTON, JR. CODE 700A

TO: LES FLYNN, KEMRON ENV.

SUBJ: WASTE OIL LINES TESTING, 1988, 89 & 90

1. LES PER OUR CONSERVATION 25 SEP 91 THE INFORMATION IS AS FOLLOWS.

(A) OCT. 13, 1988:
PRESSURE TESTED WASTE OIL LINE FROM TANK 3906-O TO, TANKS 39-A & D, 3901-A AND PIER KILO, FOR TWO (2) HOURS @ 40 PSI

(B) NOV. 7, 1989:
PRESSURE TESTED WASTE OIL LINE FROM TANK 3901-A TO, TANKS 39-A & D, 3906-O AND PIER KILO, FOR TWO (2) HOURS @ 45 PSI
PRESSURE LOSS DURING TEST 3 PSI.

(C) NOV. 8, 1990:
PRESSURE TESTED WASTE OIL LINE FROM TANK 3901-A TO, TANKS 39-A & D, 3906-O AND PIER KILO, FOR TWO (2) HOURS @ 45 PSI
PRESSURE LOSS DURING TEST 3 PSI.

S. A. Washington Jr.

S. A. WASHINGTON, JR.
DEPUTY DIRECTOR

Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To LES FLYNN	From S. A. WASHINGTON
Co. KEMRON ENV.	Co. Naval Supply Center
Dept.	Phone # (803) 743-6086
Fax # 404-636-7162	Fax # 803-743-[illegible]

DEPARTMENT OF THE NAVY
NAVAL SUPPLY CENTER
CHARLESTON, SOUTH CAROLINA 29408-6300

AREA CODE 803-743-
AUTOVON 563-
IN REPLY REFER TO

11018
700/067
29 JUN 92

From: Commanding Officer, Naval Supply Center, Charleston, SC
To: Southern Division, Naval Facilites Engineering Command, Charleston, SC

Subj: PRESSURE TESTING WASTE OIL SYSTEM

1. Per your request the following is submitted:

(a) Thursday, November 7, 1991, pressure tested waste oil line from tank 3901-A via 3901-B pumphouse to, tanks 39A & D, 3906K, L, M, N, O, P, Chicora Tank Farm and Pier Kilo, for two (2) hours at 45 psi pressure loss during test 3 psi. (Note: Pressure loss through valves packing gland.)

(b) Thursday, June 4, 1992, pressure tested waste oil line from tank 3901-A via 3901-B pumphouse to, tanks 39A & D, 3906K, L, M, N, O, P, Chicora Tank Farm, and Pier Kilo, for two (2) hours at 60 psi pressure loss during test none. (Note: Reason for line testing before regularly scheduled test is November 1992, line develop a leak at tank 3906L located at Chicora Tank Farm. Per SOP entire waste oil system must be tested.)

B G Stuart
LT B. G. Stuart
By direction

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 1

To Todd Daniels	From S. A. Washington
Co.	Co.
Dept.	Phone #
Fax # 743-0563	Fax # 743-1129

APPENDIX O

ENVIRONMENTAL STUDY OF BUILDING NO. 44

DEMOLITION OF ELECTRO-PLATING FACILITY

Charleston Naval Shipyard, South Carolina

Environmental Study of Building No. 44

Demolition of Electro-Plating Facility

Environmental Study
of Building No. 44
Demolition of Electro-Plating Facility
Charleston Naval Shipyard

Prepared for
Department of Navy

Contract N62467-88-D-1607

April, 1991

Davis & Floyd, Inc. Job No. 5548.00

Prepared by

Davis & Floyd, Inc.
Engineers
Greenwood, South Carolina

TABLE OF CONTENTS

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1.0 INTRODUCTION	1.1
2.0 STUDY RESULTS	2.1
2.1 Existing Conditions	2.1
2.2 Laboratory Results	2.4
2.3 Demolition Considerations	2.5
2.4 Cost Estimates	2.6
3.0 CONCLUSIONS AND RECOMMENDATIONS	3.1

APPENDICES

Appendix 1 - Laboratory Analyses - Metals

Appendix 2 - Floor Plan With Tank Locations

Appendix 3 - Laboratory Analyses - Asbestos

Appendix 4 - Cost Estimates

EXECUTIVE SUMMARY

Davis & Floyd, Inc. has been retained by the Department of Navy to conduct an environmental study of the abandoned ELECTROPLATING facility located in Building No. 44 at the Charleston Naval Shipyard in Charleston, South Carolina. The purpose of this study was to determine what actions will be necessary before the abandoned plating facility can be demolished. The facility still has in place, but not operational, most of the equipment used in the chrome plating operations.

Samples were collected from locations in the rooms for analysis to determine if the materials were contaminated or hazardous. Sample analyses indicated that materials in the rooms were contaminated with high levels of lead, chromium, nickel, cadmium, and other metals. The peeling paint on the walls showed high levels of lead content. These results conclude that all materials in the five rooms should be considered contaminated and disposed of as hazardous wastes during demolition. Bulk sample analyses also indicate that the roofing material used on the plating facility contains asbestos.

On the outside of the building, on Hobson Avenue, there are several transformer substations which have large conduits which run along the side of the Building No. 44 plating facility, up onto the upper level roof, then along the side of the hangar portion of Building No. 44. The conduit support structure is attached to the lower level roof and also has supports on the upper level roof. These conduits provide electrical power for the remainder of the attached building which must remain in service. Thus, another means of supports will have to be installed prior to demolition of the plating facility so that power will not be interrupted to the remaining building. There is also an active steam line which runs through the plating facility to the hangar portion of the building. This steam line will also have to be relocated prior to demolition.

Because of the aforementioned items, demolition of the plating facility will have to be carefully planned and coordinated to make certain that the active lines to other areas are not accidentally put out of service. Removal of the equipment on the roofs would need to be done prior to installation of the support structures for the conduits.

The estimated costs of the demolition is based on the fact that the materials located inside the plating facility will have to be disposed of as hazardous wastes. The estimated cost of the demolition of the plating facility is $208,712.

1.0 INTRODUCTION

The purpose of this environmental study was to determine what actions will be necessary to demolish the abandoned plating facility located in Building No. 44. The building is located on Hobson Avenue between Building No. 5 and Building No. 57. The plating facility consists of five rooms. Three of the rooms were used for the main plating operation (the Cleaning Room, the Ornamental Plating Room, and the Chrome Plating Room). The other two rooms are the Buffing Room and the Receiving & Storage Room. These two rooms are part of the main portion of Building No. 44 and are not slated for demolition, but only removal of all materials and being cleaned. The plating rooms portion of the building is slated to be demolished down to the concrete slab.

The facility still has in place, but not operational, most of the equipment used in the chrome plating operations. There are approximately 40 metal tanks, 30 exhaust hoods, associated piping and electrical wiring, metal supports, catwalks around the tanks, various trash & debris, and other items throughout the plating rooms. On the roof there are 15 exhaust fan systems with associated ductwork that were used with the plating operations. Nine fans are on the lower level of the roof and six are on the upper roof level.

2.0 STUDY RESULTS

The following sections are a discussion of the overall results of the environmental study and matters which may be of possible concern to the Charleston Naval Shipyard.

2.1 Existing Conditions

As previously stated the plating operations consists of five rooms. Most of the equipment from the abandoned operations is still in place or in pieces in the building. The Receiving & Storage Room (approximately 480 square feet) has the Motor Control Center cabinet in place, other electrical appurtenances, a hot water heater, and a fiberglass tank. The Buffing Room (approximately 350 square feet) has had all the equipment removed except for a storage cabinet and the exhaust ductwork from the buffing operation. This ductwork connects to a separator cyclone exhaust unit on the lower level roof. There is a floor drain trench which runs through both of these rooms which was full of debris.

The Cleaning Room (approximately 415 square feet) had seven process tanks remaining with associated piping and electrical connections, overhead monorails, and six fume exhaust hoods with ductwork. The metal tanks ranged in size from about 130 gallons to about 400 gallons. The floor was covered with wooden pallets used as grates. There was considerable amounts of debris under the wooden grates.

The Ornamental Plating Room (approximately 700 square feet) had thirteen process tanks, eight fume exhaust hoods, overhead monorail system, metal stands for the remote control centers, piping, electrical, and other components. The metal tanks ranged in size from about 130 gallons to about 480 gallons. The floor was also covered with wooden grates and there was also a significant amount of debris under these grates from the operations. Several tanks in the room still had acid solutions in them. One tank (Tank 58) had about 5-6" of solid crystals in the bottom along with other debris. Most tanks in all the rooms had miscellaneous debris, rubber hoses, and metal items inside the tanks.

The Chrome Plating Room (approximately 1400 square feet) has about twenty process tanks and about sixteen fume exhaust hood systems. The metal tanks range in size from 50 gallons to 1100 gallons. Some process tanks had obviously been removed from the premises. This room has an approximate 20 foot ceiling compared to a 10 foot ceiling for the other rooms. There are metal catwalks around most of the tanks with much debris underneath. There was a significant amount of debris found inside and around the tanks and tank stands. There is a monorail system located above the tank lines and associated insulated piping throughout the room for heating the tanks. There is a roll-up doorway at the end of the room allowing access to the outside. The general condition of all equipment, materials, piping, and electrical components was extremely dirty. The floor drains were full of debris.

On the lower roof level of the plating facility were the exhaust fan motors, associated ductwork and supports. The electrical disconnects for the fans were located on the wall of the main part of Building No. 44. The lower roof level had nine fan units. On the upper roof level over the Chrome Plating Room there were about six fan systems with associated ductwork and supports.

Outside the building on Hobson Avenue there are several electrical transformer substations. From these units were large conduits which initially run between Building No. 5 and Building No. 44 above the lower roof level. The support system for these conduits is attached to the lower level roof of Building No. 44 in 3 places. Some of the conduits then turn and run up to the upper level roof of Building No. 44. There are support stands attached directly to the upper level roof for these conduits. The conduits then run along the side of the main part of Building No. 44 and are supported on the side of that building. The conduits do not appear to serve any portion of the plating facility but provide power to the remainder of the building. The conduits will have to relocated or supported differently before demolition so that power to the remainder of the building will not be interrupted.

Also located on the outside of the building is an active steam line from another building which enters the Chrome Plating Room and continues on to the main part of Building No. 44. The line is part of the heating system for the plating operations. That portion has been cut off. This line will have to be relocated prior to demolition since it still supplies the main part of Building No. 44.

2.2 Laboratory Analysis

Representative samples were collected by Davis & Floyd, Inc. of materials from various tanks, debris in the floor drains, exhaust hoods, paint on the walls, and dust on the roof. The samples were analyzed for total metals, cyanides, and toxicity using the TCLP procedures. Laboratory analysis results and a chain of custody can be found in Appendix 1. Appendix 2 has a floor plan of the plating facility showing the locations of the various tanks with their respective ID numbers. Results indicate that the materials in the rooms should be considered contaminated with high levels of lead, chromium, cadmium, nickel, and other metals. The TCLP toxicity tests showed that samples were only found toxic for metals. None were found toxic due to herbicides, pesticides, semi-volatiles or volatiles. The peeling paint on the walls showed high levels of lead content. All materials in the rooms and on the roof should be considered contaminated and disposed of as hazardous wastes. Some tanks were found to contain acid solutions and other materials used in the plating operations. These tanks will have to be cleaned out and have these materials disposed of properly as hazardous wastes.

Representative bulk samples of suspect asbestos-containing materials were collected by Davis & Floyd, Inc. for analysis. Laboratory analysis results and sample log can be found in Appendix 3. Materials sampled included various sizes of pipe insulation & hard joint pipe insulation from the interior of the building, floor covering, and roofing materials. The only samples found to contain asbestos were the roofing materials. Therefore, during the building demolition, the roofing material should be removed and disposed of as asbestos-contained material. There was suspect pipe insulation on the outside portion of the active steam line which runs through the Chrome Plating Room. This material was not sampled, but appears to be and should be assumed to be asbestos-containing.

2.3 Demolition Considerations

Because of the existing active systems which will be affected by demolition, careful planning should be utilized in the design of the demolition. The equipment and ductwork on the roof of the plating facility will have to be removed before work can be done to re-support the conduits which run along side and over the building. Special consideration and planning will be have to be given to using crane systems to remove the equipment from the roof. Because the buildings are so close together, the only access for a crane is on Hobson Avenue and at the back of the Chrome Plating Room. There is no access to the side of the facility. Special care will have to be utilized not to damage the electrical substations located on Hobson Avenue and protect the adjacent building.

All of the inside demolition work and dismantling of equipment and materials should be done by persons qualified in handling of hazardous materials and in the proper use of personal protective equipment. Some of the process tanks will have to be cleaned out before disposal as hazardous wastes. In particular Tank Nos. 54, 57, 47, 11, 12, 8, A, and F all had some liquid materials in them which would have to be disposed of as hazardous wastes. The debris in the floor drains and trenches will have to vacuumed and disposed of as hazardous wastes. After all the equipment and building contents has been removed, the walls of all the rooms should be decontaminated by sandblasting the paint, etc. These waste materials would be disposed of as hazardous wastes.

2.4 Cost Estimate

The estimated costs assume that all the materials will be disposed of as hazardous wastes. Cost estimate sheets are located in Appendix 4. To dispose of the equipment as non-hazardous wastes would require complete decontamination and extensive lab testing to determine that the equipment is "clean". This option would be more expensive than disposing of the material as hazardous waste.

The estimates are broken down into three separate areas: asbestos removal, installations, and demolition. The asbestos removal includes the removal of the asbestos roofing materials and removal of a portion of the assumed asbestos-containing insulation on the active steam line which runs through the Chrome Plating Room. The installations include the relocating of the active steam line, installing a circuit to an active 600 amp panel, and the construction of supports for the electrical conduits which run along the side and on top of the facility.

The demolition portion includes dismantling of all equipment and placing in lined roll-off boxes for disposal, the use of material handling equipment to load the materials, and the cleaning of the walls. Also included in the demolition cost is the disposal of all materials, transportation to the disposal site, and demolition of the empty building. The estimated cost of this operation is $208,712.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Laboratory analyses indicate that all the materials in the five rooms should be considered contaminated. Since only the three plating rooms are to be completely demolished (down to the concrete floor slab only), the contents in the two interior rooms of the plating facility, the Buffing Room and the Receiving & Storage Room, should be disposed of as hazardous wastes along with materials from the three plating rooms. All the surfaces should be completely decontaminated before any remodeling of the two remaining areas. Once all the contaminated equipment and materials are removed from the inside of the facility and the walls and surfaces have been properly cleaned, then the demolition materials of the building structure, down to the concrete floor slab, can be disposed of as normal demolition waste. The possibility of subsurface contamination beneath the concrete floor slab is being investigated under a separate project. That investigation will provide recommendations relative to demolition and disposal methods for the concrete floor slab.

Due to the existing conditions of the active electrical conduits on the outside of the building and the steam line, considerations must be given to installing new support systems or relocate these items prior to the actual demolition of the plating facility.

Careful planning and coordination should be used in the demolition project for the plating facility. A qualified contractor experienced in handling industrial hazardous wastes and equipment should be used for the dismantling and disposal of all the contaminated equipment and debris from inside the building. A qualified roofing contractor must be used to remove the asbestos-containing roofing materials. The estimated cost of demolition is $208,712.

APPENDICES

APPENDIX 1

Laboratory Analyses - Metals

Davis & Floyd, Inc. — Laboratory Analysis Report

Page 1
Received: 01/28/91 02/20/91 09:21:39

Work Order # 91-01-161

REPORT TO: CHARLESTON NAVAL BASE
RUDY POWELL
DAVIS & FLOYD, INC.

PREPARED BY: Davis & Floyd, Inc.
P.O. Drawer 428
Greenwood, S.C. 29648

CERTIFIED BY
JOHN_MCCORD

ATTEN RUDY POWELL

PHONE (803)-229_5211

WORK ID JOB # 5548.00
P.O. #
TAKEN DAVIS & FLOYD, INC.
TYPE SOLID & WASTE WATER
NUMBER OF SAMPLES 30

Comments:
WE ARE PLEASED TO PROVIDE THIS CERTIFIED REPORT OF ANALYSES. FEEL FREE TO TELEPHONE IF FURTHER EXPLANATION IS REQUIRED. UNLESS OTHER ARRANGEMENTS HAVE BEEN MADE, SAMPLES WILL BE DISPOSED OF OR RETURNED 28 DAYS FROM THE DATE OF THIS REPORT.

	SAMPLE IDENTIFICATION	DATE COLLECTED
01	SP1 PEELING PAINT OFF WALL	01/24/91 15:06:00
02	SP2 TANK 41	01/24/91 15:20:00
03	SP3 TANK 42	01/24/91 15:30:00
04	SP4 TANK 49	01/24/91 15:50:00
05	SP5 TANK 47	01/24/91 16:00:00
06	SP6 TANK 45	01/24/91 15:34:00
07	SP7 TANK 29	01/24/91 16:10:00
08	SP8 TANK 22	01/24/91 16:17:00
09	SP9 MATERIAL UNDER FLOOR G	01/25/91 08:30:00
10	SP10 WAXER TANK	01/25/91 09:04:00
11	SP11 TANK 11	01/25/91 09:18:00
12	SP12 FLOOR AREA BEHIND TAN	01/25/91 10:08:00
13	SP13 TANK F	01/25/91 10:18:00
14	SP14 GRATE INFLOOR	01/25/91 10:38:00
15	SP15 TANK 1	01/25/91 10:30:00
16	SP16 TANK 3	01/25/91 10:35:00
17	SP17 TANK 5	01/25/91 10:40:00
18	SP18 ANODE CLEANER TANK	01/25/91 10:45:00
19	SP19 TANK 6	01/25/91 10:52:00
20	SP20 TANK 21	01/25/91 10:56:00
21	SP21 TANK 28A	01/25/91 13:45:00
22	SP22 TANK 33	01/25/91 13:50:00
23	SP23 TANK 36	01/25/91 13:55:00
24	SP24 TANK 56	01/25/91 14:00:00
25	SP25 DUCTS FR. TANKS 54,56	01/25/91 14:05:00
26	SP26 TANK 8	01/25/91 13:30:00
27	SP27 TANKS 57 & 58	01/25/91 14:10:00
28	SP28 TANK 54	01/25/91 14:15:00
29	SP29 DUST FROM ROOF AREA	01/25/91 14:25:00
30	TRIP BLANK	

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

02/20/91 09:21:39

Work Order # 91-01-161

Test Description	Units	01 SP1 PEELING PAI OFF WALL	02 SP2 TANK 41	03 SP3 TANK 42	04 SP4 TANK 49
SILVER	mg/kg	<1.0	60.0	<1.0	17.5
CADMIUM	mg/kg	90.2	167	224	214
CHROMIUM	mg/kg	598	579	5110	83
NICKEL	mg/kg	118	2130	887	555
MERCURY	mg/kg	2.7	1.3	0.63	0.97
LEAD	mg/kg	5836	10017	7330	4363
CYANIDE (TOTAL)	mg/kg	43.5	2.2	2.3	2.8

Test Description	Units	05 SP5 TANK 47	14 SP14 GRATE IN-FLOOR	15 SP15 TANK 1	16 SP16 TANK 3
SILVER	mg/kg	38.7	<1.0	4.5	16.7
CADMIUM	mg/kg	270	56.9	2.02	7.9
CHROMIUM	mg/kg	1095	3624	129100	85350
NICKEL	mg/kg	8030	285	93.7	46
MERCURY	mg/kg	0.07	0.19	0.10	<0.07
LEAD	mg/kg	6420	6297	446000	133800
CYANIDE (TOTAL)	mg/kg	<0.08	1.8	<50 X	<5.0 X

Test Description	Units	17 SP17 TANK 5	18 SP18 ANODE CLEA TANK	19 SP19 TANK 6	20 SP20 TANK 21
SILVER	mg/kg	<1.0	4.5	<1.0	11.9
CADMIUM	mg/kg	6.6	20.8	50.5	23.2
CHROMIUM	mg/kg	145100	2958	123100	627
NICKEL	mg/kg	123	18	88	103
MERCURY	mg/kg	0.12	0.13	0.13	0.13
LEAD	mg/kg	231600	10903	43610	436
CYANIDE (TOTAL)	mg/kg	<5.0 X	3.33	<2.5 X	268

Test Description	Units	21 SP21 TANK 28A	22 SP22 TANK 33	23 SP23 TANK 36	24 SP24 TANK 56
SILVER	mg/kg	145.3	28.6	54.2	2.4
CADMIUM	mg/kg	84340	397	92.8	19.7
CHROMIUM	mg/kg	392	77	280	75480
NICKEL	mg/kg	73	736	1244	11940
MERCURY	mg/kg	<0.07	<0.06	0.10	<0.06
LEAD	mg/kg	62.6	342	55	6.7
CYANIDE (TOTAL)	mg/kg	5400	6920	13.0	2.81

Test Description	Units	25 SP25 DUCTS FR. TANKS 54,56	26 SP26 TANK 8	27 SP27 TANKS 57 & 58	28 SP28 TANK 54
SILVER (TOTAL)	mg/l		<0.01		
SILVER	mg/kg	65.3		9.8	1.5
CADMIUM (TOTAL)	mg/l		0.497		
CADMIUM	mg/kg	64.3		72.2	19.9
CHROMIUM (TOTAL)	mg/l		182		
CHROMIUM	mg/kg	472		76	32.8
NICKEL (TOTAL)	mg/l		2.30		
NICKEL	mg/kg	1226		92420	1609
MERCURY (TOTAL)	mg/l		0.017		
MERCURY	mg/kg	0.10		<0.07	<0.07
LEAD (TOTAL)	mg/l		0.55		
LEAD	mg/kg	193		27	14.8
CYANIDE (TOTAL)	mg/l		0.684		
CYANIDE (TOTAL)	mg/kg	15.8		0.9	0.17

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91 02/20/91 09:21:39 Work Order # 91-01-161

Test Description	Units	29 SP29 DUST FROM ROOF AREA
SILVER	mg/kg	1.5
CADMIUM	mg/kg	9.80
CHROMIUM	mg/kg	222
NICKEL	mg/kg	43
MERCURY	mg/kg	<0.07
LEAD	mg/kg	180
CYANIDE (TOTAL)	mg/kg	0.84

Davis & Floyd, Inc.

Laboratory Analysis Report

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Work Order # 91-01-161

Received: 01/28/91

Results by Sample

SAMPLE ID SP6 TANK 45

FRACTION 06A TEST CODE TCLPHB NAME TCLP HERBICIDES

Date & Time Collected 01/24/91 15:34:00 Category

ANALYST DMM ANALYZED 02/14/91 FACTOR 5 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Work Order # 91-01-161

Received: 01/28/91

Results by Sample

SAMPLE ID SP6 TANK 45

FRACTION 06A TEST CODE TCLPPS NAME TCLP PESTICIDES
Date & Time Collected 01/24/91 15:34:00 Category

ANALYST DMM ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP6 TANK 45

FRACTION 06A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES
Date & Time Collected 01/24/91 15:34:00 Category

ANALYST MPT ANALYZED 02/13/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed
BDL = below the required detection limit.

Received: 01/28/91

Results by Sample

SAMPLE ID SP6 TANK 45

FRACTION 06B TEST CODE TCLPTM NAME TCLP TRACE METALS
Date & Time Collected 01/24/91 15:34:00 Category

ANALYST BDL EXTRACTED ________ ANALYZED 02/12/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	<0.32 X	5.0
Barium	0.40	100.0
Cadmium	6.83	1.0
Chromium	0.11	5.0
Lead	0.10	5.0
Mercury	0.0005	0.2
Selenium	<0.05	1.0
Silver	<0.02	5.0

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP6 TANK 45

FRACTION 06C TEST CODE TCLPVO NAME TCLP VOLATILES
Date & Time Collected 01/24/91 15:34:00 Category

ANALYST KLS ANALYZED 02/05/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Received: 01/28/91

Results by Sample

SAMPLE ID SP7 TANK 29

FRACTION 07A TEST CODE TCLPHB NAME TCLP HERBICIDES
Date & Time Collected 01/24/91 16:10:00 Category

ANALYST DMM ANALYZED 02/14/91 FACTOR 5 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

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Results by Sample

SAMPLE ID SP7 TANK 29

FRACTION 07A TEST CODE TCLPPS NAME TCLP PESTICIDES
Date & Time Collected 01/24/91 16:10:00 Category

ANALYST DMM ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

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Received: 01/28/91 Results by Sample

SAMPLE ID SP7 TANK 29 FRACTION 07A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES

Date & Time Collected 01/24/91 16:10:00 Category

ANALYST MPT ANALYZED 02/13/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP7 TANK 29

FRACTION 07B TEST CODE TCLPTM NAME TCLP TRACE METALS
Date & Time Collected 01/24/91 16:10:00 Category

ANALYST BDL EXTRACTED ANALYZED 02/14/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	0.013	5.0
Barium	160	100.0
Cadmium	26.0	1.0
Chromium	1612	5.0
Lead	<0.005	5.0
Mercury	0.010	0.2
Selenium	0.15	1.0
Silver	<0.02	5.0

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed

Received: 01/28/91

Results by Sample

SAMPLE ID SP7 TANK 29

FRACTION 07C TEST CODE TCLPVO NAME TCLP VOLATILES
Date & Time Collected 01/24/91 16:10:00 Category

ANALYST KLS ANALYZED 02/06/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Received: 01/28/91

Results by Sample

SAMPLE ID SP8 TANK 22

FRACTION 08A   TEST CODE TCLPHB   NAME TCLP HERBICIDES
Date & Time Collected 01/24/91 16:17:00   Category

ANALYST DMM   ANALYZED 02/14/91   FACTOR 5   UNITS ug/l   VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

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Results by Sample

SAMPLE ID SP8 TANK 22

FRACTION 08A TEST CODE TCLPPS NAME TCLP PESTICIDES

Date & Time Collected 01/24/91 16:17:00 Category

ANALYST DMM ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

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Results by Sample

SAMPLE ID SP8 TANK 22

FRACTION 08A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES
Date & Time Collected 01/24/91 16:17:00 Category

ANALYST MPT ANALYZED 02/13/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed
BDL = below the required detection limit.

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Received: 01/28/91

Results by Sample

SAMPLE ID SP8 TANK 22

FRACTION 08B TEST CODE TCLPTM NAME TCLP TRACE METALS

Date & Time Collected 01/24/91 16:17:00 Category

ANALYST BDL EXTRACTED ________ ANALYZED 02/14/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	<0.05	5.0
Barium	0.08	100.0
Cadmium	0.050	1.0
Chromium	0.47	5.0
Lead	<0.05	5.0
Mercury	0.0042	0.2
Selenium	<0.05	1.0
Silver	0.06	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP8 TANK 22

FRACTION 08C TEST CODE TCLPVO NAME TCLP VOLATILES

Date & Time Collected 01/24/91 16:17:00 Category

ANALYST KLS ANALYZED 02/05/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

B = compound detected in extraction blank.

J = estimate below required detection limit.

D = secondary dilution required.

X = interference - dilution required.

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP9 MATERIAL UNDER FLOOR G FRACTION 09A TEST CODE TCLPHB NAME TCLP HERBICIDES
Date & Time Collected 01/25/91 08:30:00 Category

ANALYST DMM ANALYZED 02/14/91 FACTOR 5 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed
BDL = below the required detection limit.

Received: 01/28/91

Results by Sample

SAMPLE ID SP9 MATERIAL UNDER FLOOR G   FRACTION 09A   TEST CODE TCLPPS   NAME TCLP PESTICIDES
Date & Time Collected 01/25/91 08:30:00   Category

ANALYST DMM   ANALYZED 02/12/91   FACTOR 10   UNITS ug/l   VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP9 MATERIAL UNDER FLOOR G FRACTION 09A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES
Date & Time Collected 01/25/91 08:30:00 Category

ANALYST MPT ANALYZED 02/13/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP9 MATERIAL UNDER FLOOR G FRACTION 09B TEST CODE TCLPTM NAME TCLP TRACE METALS
Date & Time Collected 01/25/91 08:30:00 Category

ANALYST BDL EXTRACTED ________ ANALYZED 02/12/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	<0.05	5.0
Barium	5.35	100.0
Cadmium	30.4	1.0
Chromium	0.13	5.0
Lead	0.12	5.0
Mercury	0.0009	0.2
Selenium	<0.05	1.0
Silver	0.18	5.0

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed

Davis & Floyd, Inc. Laboratory Analysis Report

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Work Order # 91-01-161

Results by Sample

SAMPLE ID SP9 MATERIAL UNDER FLOOR G FRACTION 09C TEST CODE TCLPVO NAME TCLP VOLATILES
Date & Time Collected 01/25/91 08:30:00 Category

ANALYST KLS ANALYZED 02/05/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP10 WAXER TANK

FRACTION 10A TEST CODE TCLPHB NAME TCLP HERBICIDES

Date & Time Collected 01/25/91 09:04:00 Category

ANALYST DMM ANALYZED 02/14/91 FACTOR 5 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

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Received: 01/28/91 Results by Sample

SAMPLE ID SP10 WAXER TANK FRACTION 10A TEST CODE TCLPPS NAME TCLP PESTICIDES
Date & Time Collected 01/25/91 09:04:00 Category

ANALYST DMM ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed
BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Work Order # 91-01-161

Received: 01/28/91

Results by Sample

SAMPLE ID SP10 WAXER TANK

FRACTION 10A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES

Date & Time Collected 01/25/91 09:04:00 Category

ANALYST MPT ANALYZED 02/13/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

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Received: 01/28/91 Results by Sample

SAMPLE ID SP10 WAXER TANK FRACTION 10B TEST CODE TCLPTM NAME TCLP TRACE METALS

Date & Time Collected 01/25/91 09:04:00 Category

ANALYST BDL EXTRACTED ________ ANALYZED 02/08/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	<0.05	5.0
Barium	0.17	100.0
Cadmium	0.020	1.0
Chromium	0.16	5.0
Lead	<0.05	5.0
Mercury	0.0011	0.2
Selenium	<0.05	1.0
Silver	<0.02	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

Received: 01/28/91

Results by Sample

SAMPLE ID SP10 WAXER TANK FRACTION 10C TEST CODE TCLPVO NAME TCLP VOLATILES

Date & Time Collected 01/25/91 09:04:00 Category

ANALYST KLS ANALYZED 02/06/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Received: 01/28/91

Results by Sample

SAMPLE ID SP11 TANK 11

FRACTION 11A TEST CODE TCLPHB NAME TCLP HERBICIDES
Date & Time Collected 01/25/91 09:18:00 Category

ANALYST DMM ANALYZED 02/14/91 FACTOR 5 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP11 TANK 11

FRACTION 11A TEST CODE TCLPPS NAME TCLP PESTICIDES
Date & Time Collected 01/25/91 09:18:00 Category

ANALYST DMM ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP11 TANK 11

FRACTION 11A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES
Date & Time Collected 01/25/91 09:18:00 Category

ANALYST MPT ANALYZED 02/13/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Work Order # 91-01-161

Received: 01/28/91

Results by Sample

SAMPLE ID SP11 TANK 11

FRACTION 11B TEST CODE TCLPTM NAME TCLP TRACE METALS

Date & Time Collected 01/25/91 09:18:00 Category

ANALYST BDL EXTRACTED ________ ANALYZED 02/12/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	10.1	5.0
Barium	0.51	100.0
Cadmium	1.938	1.0
Chromium	12170	5.0
Lead	0.105	5.0
Mercury	0.0021	0.2
Selenium	<0.025 X	1.0
Silver	0.03	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP11 TANK 11

FRACTION 11C TEST CODE TCLPVO NAME TCLP VOLATILES
Date & Time Collected 01/25/91 09:18:00 Category

ANALYST KLS ANALYZED 02/06/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91 Results by Sample Work Order # 91-01-161

SAMPLE ID SP12 FLOOR AREA BEHIND TAN FRACTION 12A TEST CODE TCLPHB NAME TCLP HERBICIDES
Date & Time Collected 01/25/91 10:08:00 Category

ANALYST DMM ANALYZED 02/14/91 FACTOR 5 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed
BDL = below the required detection limit.

Received: 01/28/91

Results by Sample

SAMPLE ID SP12 FLOOR AREA BEHIND TAN FRACTION 12A TEST CODE TCLPPS NAME TCLP PESTICIDES
Date & Time Collected 01/25/91 10:08:00 Category

ANALYST DMH ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP12 FLOOR AREA BEHIND TAN FRACTION 12A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES
Date & Time Collected 01/25/91 10:08:00 Category

ANALYST MPT ANALYZED 02/14/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP12 FLOOR AREA BEHIND TAN FRACTION 12B TEST CODE TCLPTM NAME TCLP TRACE METALS

Date & Time Collected 01/25/91 10:08:00 Category

ANALYST EDL EXTRACTED ________ ANALYZED 02/12/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	<0.05	5.0
Barium	<0.2 X	100.0
Cadmium	0.411	1.0
Chromium	218	5.0
Lead	<0.08 X	5.0
Mercury	0.0005	0.2
Selenium	<0.05	1.0
Silver	<0.02	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

Davis & Floyd, Inc. | Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP12 FLOOR AREA BEHIND TAN FRACTION 12C TEST CODE TCLPVO NAME TCLP VOLATILES
Date & Time Collected 01/25/91 10:08:00 Category

ANALYST KLS ANALYZED 02/06/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Davis & Floyd, Inc. — Laboratory Analysis Report

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Received: 01/28/91 — Results by Sample

SAMPLE ID SP13 TANK F — FRACTION 13A — TEST CODE TCLPHB — NAME TCLP HERBICIDES

Date & Time Collected 01/25/91 10:18:00 — Category

ANALYST DMM — ANALYZED 02/14/91 — FACTOR 5 — UNITS ug/l — VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
2,4-D	BDL	0.5
2,4,5-TP (Silvex)	BDL	0.05

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP13 TANK F

FRACTION 13A TEST CODE TCLPPS NAME TCLP PESTICIDES

Date & Time Collected 01/25/91 10:18:00 Category

ANALYST DMM ANALYZED 02/12/91 FACTOR 10 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Chlordane	BDL	5
Endrin	BDL	1
Heptachlor	BDL	0.5
Lindane	BDL	0.5
Methoxychlor	BDL	0.5
Toxaphene	BDL	10

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc.

Laboratory Analysis Report

Work Order # 91-01-161

Received: 01/28/91

Results by Sample

SAMPLE ID SP13 TANK F

FRACTION 13A TEST CODE TCLPSV NAME TCLP SEMIVOLATILES

Date & Time Collected 01/25/91 10:18:00 Category

ANALYST MPT ANALYZED 02/19/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
1,4-Dichlorobenzene	BDL	100
o-Cresol	BDL	100
m-Cresol	BDL	100
p-Cresol	BDL	100
Hexachloroethane	BDL	100
Nitrobenzene	BDL	100
Hexachlorobutadiene	BDL	100
2,4,6-Trichlorophenol	BDL	100
2,4,5-Trichlorophenol	BDL	500
2,4-Dinitrotoluene	BDL	500
Hexachlorobenzene	BDL	100
Pentachlorophenol	BDL	500
Pyridine	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed

BDL = below the required detection limit.

Davis & Floyd, Inc. Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP13 TANK F

FRACTION 13B TEST CODE TCLPTM NAME TCLP TRACE METALS
Date & Time Collected 01/25/91 10:18:00 Category

ANALYST BDL EXTRACTED ANALYZED 02/08/91 VERIFIED JHM

COMPOUND	RESULT mg/l	REG LEVEL mg/l
Arsenic	<0.05	5.0
Barium	0.10	100.0
Cadmium	0.003	1.0
Chromium	<0.01	5.0
Lead	0.12	5.0
Mercury	0.0004	0.2
Selenium	<0.05	1.0
Silver	<0.02	5.0

NOTES AND DEFINITIONS FOR THIS REPORT
NA = not analyzed

D a v i s & F l o y d , I n c . Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID SP13 TANK F

FRACTION 13C TEST CODE TCLPVO NAME TCLP VOLATILES
Date & Time Collected 01/25/91 10:18:00 Category

ANALYST KLS ANALYZED 01/31/91 FACTOR 20 UNITS ug/l VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	200
1,1-Dichloroethylene	BDL	100
Chloroform	BDL	100
1,2-Dichloroethane	BDL	100
Methyl ethly ketone	BDL	200
Carbon tetrachloride	BDL	100
Trichloroethylene	BDL	100
Benzene	BDL	100
Tetrachloroethylene	BDL	100
Chlorobenzene	BDL	100

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

Davis & Floyd, Inc.

Laboratory Analysis Report

Received: 01/28/91

Work Order # 91-01-161

Results by Sample

SAMPLE ID TRIP BLANK

FRACTION 30A   TEST CODE TCLPVO   NAME TCLP VOLATILES
Date & Time Collected not specified   Category

ANALYST KLS   ANALYZED 02/05/91   FACTOR 1   UNITS ug/l   VERIFIED JHM

COMPOUND	RESULT	DET LIMIT
Vinyl chloride	BDL	10
1,1-Dichloroethylene	BDL	5.0
Chloroform	BDL	5.0
1,2-Dichloroethane	BDL	5.0
Methyl ethly ketone	BDL	10
Carbon tetrachloride	BDL	5.0
Trichloroethylene	BDL	5.0
Benzene	BDL	5.0
Tetrachloroethylene	BDL	5.0
Chlorobenzene	BDL	5.0

NOTES AND DEFINITIONS FOR THIS REPORT

NA = not analyzed
BDL = below the required detection limit.
B = compound detected in extraction blank.
J = estimate below required detection limit.
D = secondary dilution required.
X = interference - dilution required.

DEFINITIONS AND EXPLANATIONS:

1. THE " X " INDICATES A MATRIX INTERFERENCE WHICH MAY REQUIRE A DILUTION OR WHICH PREVENTS THE REPORTING OF A RESULT. DETECTION LIMITS HAVE BEEN ADJUSTED WHERE APPLICABLE.

DAVIS & FLOYD

Chain of Custody Form

816 East Durst Street, Greenwood, S.C. 29646 Phone (803)229-5211 Fax (803)229-7844

PROJ. NO.	PROJECT NAME
5548.00	Charleston Naval Base

SAMPLERS NAME/AFFILIATION: (PRINTED) John L McMahan III

SAMPLE NO.	DATE	TIME	COMP.	GRAB	SAMPLE DESCRIPTION	NO. OF CONTAINERS	*Metals/Cr Tot. 500ml		TCLP VOA 40ml	TCLP Organics 500ml	TCLP Metals 500ml	TCLP VOA 250ml	TCLP Organics 4 liter	TCLP Metals liter		Metals liter	Cr Tot liter		REMARKS	SAMPLE TYPE	POTENTIAL HAZARD
	1-24-91	1506		✓	Sp01 (Peeling Paint off Wall)	1	1												*Metals: Ag, Cd,	SD	✓
		1520		✓	Sp02 (Tank #41)	1	1												Cr, Hg, Ni, Pb	SD	✓
		1530		—	Sp03 (Tank #42)	1	1													SD	—
		1550		—	Sp04 (Tank #49)	1	1													SD	*
		1600		—	Sp05 (Tank #47)	1	1													SD	—
		1534		—	Sp06 (Tank #45)	4			2	1	1									SD	—
		1610		—	Sp07 (Tank #29)	4			2	1	1									SD	—
		1617		—	Sp08 (Tank #22)	4			2	1	1									SD	—
	1-25-91	0830		—	Sp09 (Material Under Floor Grates)	4			2	1	1									SD	—
		0904		—	Sp10 (Waxer Tank)	4			2	1	1									SD	—
		0918		—	Sp11 (Tank 11) ~~(Floor Area Behind Tank #?)~~ JLMc 1-25-91	4			2	1	1									SD	*
		1008		—	Sp12 (Floor Area Behind Tank #8)	4			2	1	1									SD	—
		1028		—	Sp13 (Tank F)	4						2	1	1						WW	—
		1038		—	Sp14 (Grate in floor)	1	1		~~2~~ JLMc 1-25-91											SD	—
		1030		—	Sp15 (Tank #1)	1	1													SD	—
		1035		—	Sp16 (Tank #3)	1	1													SD	—
		1040		—	Sp17 (Tank #5)	1	1													SD	—

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)
John L McMahan III	1-25-91 / 1914				

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED FOR LAB BY: (SIGNATURE)	DATE / TIME	REMARKS
		Melissa Coffey	1/28/91 06:30	

DW-DRINKING WATER GW-GROUND WATER WW-WASTE WATER RC-RCRA HW-HAZARDOUS WASTE SW-SURFACE WATER SD-SOLID IM-IMPINGER SOLUTION AB-ABSORBENT TUBE

DAVIS & FLOYD

Chain of Custody Form

816 East Durst Street, Greenwood, S.C. 29646 Phone (803)229-6211 Fax (803)229-7844

PROJ. NO.: 5548.00
PROJECT NAME: Charleston Naval Base
SAMPLERS NAME/AFFILIATION:(PRINTED) John L. McMahon II

PARAMETERS: *Metals 500ml / Cr-Tot; *Metals liter / Cr-Tot liter

SAMPLE NO.	DATE	TIME	COMP.	GRAB	SAMPLE DESCRIPTION	NO. OF CONTAINERS	*Metals 500ml / Cr-Tot	*Metals liter / Cr-Tot liter	REMARKS	SAMPLE TYPE	POTENTIAL HAZARD
	1-25-91	1045		✓	Sp18 (Anode Cleaner Tank)	1	1		* Metals: Ag, Cd,	SD	—
	↓	1052		✓	Sp19 (Tank #6)	1	1		Cr, Hg, Ni, Pb,	SD	—
		1056		✓	Sp20 (Tank # 21)	1	1			SD	—
		1345		—	Sp21 [Tank # 28A (Cd)]	1	1			SD	—
		1350		—	Sp22 [Tank # 33 (CuCn)]	1	1			SD	*
		1355		—	Sp23 (Tank # 36)	1	1			SD	—
		1400		—	Sp24 (Tank 56)	1	1			SD	*
		1405		—	Sp25 (~~Tank 54~~ Ducts form Tanks 57+58) JLMc 1-25-91	1	1			SD	—
		1330		—	Sp26 (Tank #8)	2		1 1		WW	*
		1410	—		Sp27 (Tanks # 57+58)	1	1			SD	*
		1415		—	Sp28 (Tank # 54)	1	1			SD	*
	↓	1425		✓	Sp29 (Dust from Roof Area)	1	1			SD	—

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)
John L. McMahon II	1-25-91 / 1914				

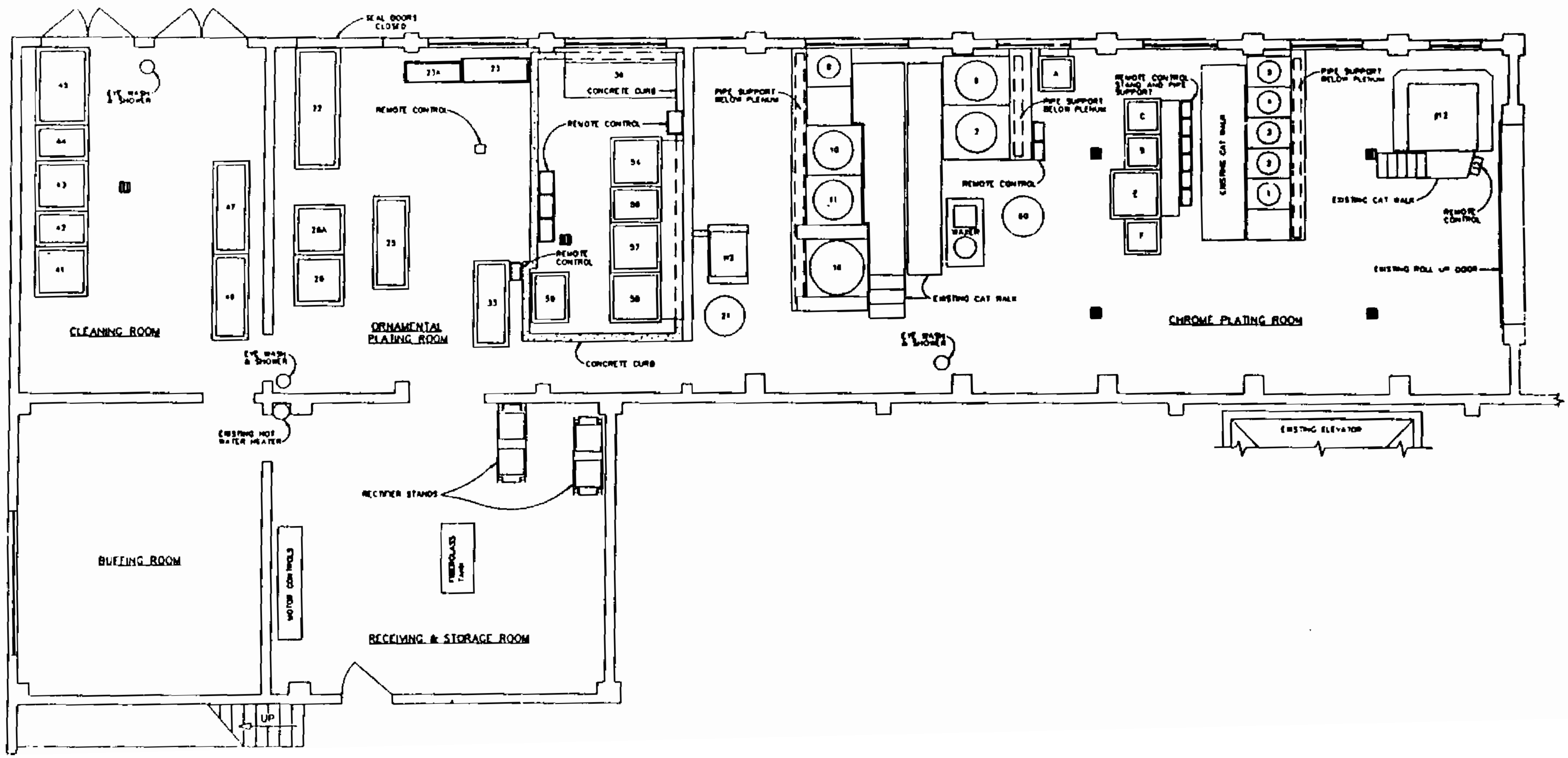
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED FOR LAB BY: (SIGNATURE)	DATE / TIME	REMARKS
		Melissa Colby	1/28/91 / 10:30	

DW-DRINKING WATER WW-WASTE WATER HW-HAZARDOUS WASTE SD-SOLID AB-ABSORBENT TUBE
GW-GROUND WATER RC-RCRA SW-SURFACE WATER IM-IMPINGER SOLUTION

APPENDIX 2

Floor Plan Showing Tank Locations

BUILDING NO. 44 ELECTRO-PLATING FACILITY
TANK LOCATIONS



APPENDIX 3

Laboratory Analyses - Asbestos

Davis & Floyd, Inc.

CONSULTING ENGINEERS

POST OFFICE DRAWER 428

GREENWOOD, SOUTH CAROLINA 29648

803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.

Clients sample #: 44-01 Laboratory sample #: 9100107

Sample Date: 01/25/91

Description: PIPE INSULATION-WHITE,PINK,GLASSY,GRAINY,NONFIBROUS, NONHOMOGENEOUS,WAXY

Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	05
2.	Glass Fibers :	15
3.	Mineral Wool Fibers:	00
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	70
7.	Other :	10
	Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

NOTICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample tested and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS

POST OFFICE DRAWER 428

GREENWOOD, SOUTH CAROLINA 29648

803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.

Clients sample #: 44-02 Laboratory sample #: 9100108

Sample Date: 01/25/91

Description: HARD JOINT-TAN, PINK, GRAY, GLASSY, GRAINY, NONFIBROUS, WAXY, NONHOMOGENEOUS

Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	10
2.	Glass Fibers :	15
3.	Mineral Wool Fibers:	00
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	65
7.	Other :	10
	Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

NOTICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample tested and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS
POST OFFICE DRAWER 428
GREENWOOD, SOUTH CAROLINA 29648
803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-03 Laboratory sample #: 9100109
Sample Date: 01/25/91
Description: PIPE INSULATION-WHITE,GLASSY,GRAINY,NONFIBROUS,WAXY, NONHOMOGENEOUS
Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	05
2.	Glass Fibers :	15
3.	Mineral Wool Fibers:	00
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	70
7.	Other :	10
	Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

Davis & Floyd, Inc.

CONSULTING ENGINEERS
POST OFFICE DRAWER 428
GREENWOOD, SOUTH CAROLINA 29648
803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-04 Laboratory sample #: 9100110
Sample Date: 01/25/91
Description: HARD JOINT-TAN, GRAINY, GLASSY, NONFIBROUS, NONHOMOGENEOUS, WAXY

Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	15
2.	Glass Fibers :	15
3.	Mineral Wool Fibers:	00
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	60
7.	Other :	10
	Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

NOTICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample tested and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS

POST OFFICE DRAWER 428

GREENWOOD, SOUTH CAROLINA 29648

803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-05 Laboratory sample #: 9100111
Sample Date: 01/25/91
Description: FLOOR COVERING-GREEN,HARD,NONFIBROUS,HOMOGENEOUS,WAXY

Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	03
2.	Glass Fibers :	00
3.	Mineral Wool Fibers:	00
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	80
7.	Other :	17
	Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

N[illegible]CE: This test must not be used to claim product endorsement by VLAP or agency of the U.S. Government and relates only to the sample [illegible]ted and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS
POST OFFICE DRAWER 428
GREENWOOD, SOUTH CAROLINA 29648
803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-06 . Laboratory sample #: 9100112
Sample Date: 01/25/91
Description: PIPE INSULATION-WHITE,GLASSY,GRAINY,NONFIBROUS,WAXY
NONHOMOGENEOUS

Asbestos Type(s) Present:

Asbestos Materials	Estimated Percentage
1. Chrysotile :	00
2. Amosite :	00
3. Crocidolite :	00
4. Anthophyllite :	00
5. Tremolite :	00
6. Actinolite :	00
Asbestos Total:	0

Other Components	Estimated Percentage
1. Cellulose Fibers :	20
2. Glass Fibers :	15
3. Mineral Wool Fibers:	00
4. Perlite :	00
5. Mica :	00
6. Binder :	55
7. Other :	10
Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4738
Laboratory NVLAP No.: 1410

NOTICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample tested and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS
POST OFFICE DRAWER 428
GREENWOOD, SOUTH CAROLINA 29648
803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-07 Laboratory sample #: 9100113
Sample Date: 01/25/91
Description: HARD JOINT-TAN,GRAINY,GLASSY,FIBROUS,NONHOMOGENEOUS, WAXY

Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	20
2.	Glass Fibers :	15
3.	Mineral Wool Fibers:	00
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	55
7.	Other :	10
	Other Total:	100

Comments -- The Method used was PLM/DS.
:

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

N[illegible]ICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample [illegible]ted and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS
POST OFFICE DRAWER 428
GREENWOOD, SOUTH CAROLINA 29648
803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-08 Laboratory sample #: 9100114
Sample Date: 01/25/91
Description: ROOF MATERIAL-BLACK,FIBROUS,HOMOGENEOUS,GLASSY,WAXY

Asbestos Type(s) Present:

Asbestos Materials		Estimated Percentage
1.	Chrysotile :	00
2.	Amosite :	00
3.	Crocidolite :	00
4.	Anthophyllite :	00
5.	Tremolite :	00
6.	Actinolite :	00
	Asbestos Total:	0

Other Components		Estimated Percentage
1.	Cellulose Fibers :	40
2.	Glass Fibers :	00
3.	Mineral Wool Fibers:	20
4.	Perlite :	00
5.	Mica :	00
6.	Binder :	30
7.	Other :	10
	Other Total:	100

Comments -- The Method used was PLM/DS.
: SAMPLE WAS ASHED.

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

NOTICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample tested and identified above.

Davis & Floyd, Inc.

CONSULTING ENGINEERS
POST OFFICE DRAWER 428
GREENWOOD, SOUTH CAROLINA 29648
803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5542.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-09 Laboratory sample #: 9100115
Sample Date: 01/25/91
Description: ROOF FLASHING--BLACK, NONFIBROUS, HOMOGENEOUS, SILKY, WAVY

Asbestos Type(s) Present: 1

Asbestos Materials	Estimated Percentage
1. Chrysotile :	10
2. Amosite :	00
3. Crocidolite :	00
4. Anthophyllite :	00
5. Tremolite :	00
6. Actinolite :	00
Asbestos Total:	10

Other Components	Estimated Percentage
1. Cellulose Fibers :	00
2. Glass Fibers :	00
3. Mineral Wool Fibers:	00
4. Perlite :	00
5. Mica :	00
6. Binder :	70
7. Other :	20
Other Total:	90

Comments -- The Method used was PLM/DS.
: SAMPLE WAS ASHED.

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I Culbertson
Date: 01/30/91
Laboratory EPA No.: 4783
Laboratory NVLAP No.: 1410

Davis & Floyd, Inc.

CONSULTING ENGINEERS

POST OFFICE DRAWER 428

GREENWOOD, SOUTH CAROLINA 29648

803-229-5211

ASBESTOS BULK SAMPLE ANALYSIS REPORT

Job # : 5548.00
Client : CHARLESTON NAVAL BASE
Location : CHROME PLATING SHOP
: CHARLESTON NAVAL SHIPYARD
: CHARLESTON, S.C.
Clients sample #: 44-10 Laboratory sample #: 9100115
Sample Date: 01/25/91
Description: ROOF EQUIPMENT FLASHING-BLACK,NONFIBROUS,HOMOGENEOUS, GLASSY,SILKY,WAVY
Asbestos Type(s) Present: 1

Asbestos Materials	Estimated Percentage
1. Chrysotile :	10
2. Amosite :	00
3. Crocidolite :	00
4. Anthophyllite :	00
5. Tremolite :	00
6. Actinolite :	00
Asbestos Total:	10

Other Components	Estimated Percentage
1. Cellulose Fibers :	00
2. Glass Fibers :	10
3. Mineral Wool Fibers:	00
4. Perlite :	00
5. Mica :	00
6. Binder :	70
7. Other :	10
Other Total:	90

Comments -- The Method used was PLM/DS.
: SAMPLE WAS ASHED.

Sampled by: BOB HYLER
Affiliation: DAVIS & FLOYD, INC.
Analyzed by: Elizabeth I. Culbertson

Signature - Elizabeth I. Culbertson
Date: 01/30/91
Laboratory EPA No.: 4788
Laboratory NVLAP No.: 1410

NOTICE: This test must not be used to claim product endorsement by NVLAP or agency of the U.S. Government and relates only to the sample tested and identified above.

DAVIS & FLOYD
P.O. Drawer 428
Greenwood, SC 29648
(803) 229-5211

Building Name: CHROME PLATING SHOP Building Number: 44
Building Address: CHARLESTON NAVAL SHIPYARD
CHARLESTON, S.C.
Building Owner: CHARLESTON NAVAL BASE
Collection Team: BOB HYLER

S A M P L E L O G / C H A I N O F C U S T O D Y

Sample ID #	Description of Sampled Material	Photo No.	Sample Site Location	Date/ Time	Mat'l ID #	Quantity Sq Ft	Quantity Ln Ft	Quantity Each
44-01	1¼"φ PIPE INSULATION (POWDER)	774-01	CLEANING ROOM - NEXT TO TANK #45	01-25-91 08:20				
44-02	1¼"φ HARD JOINT	774-02	CLEANING ROOM - NEXT TO TANK #45	01-25-91 08:25				
44-03	¾"φ PIPE INSULATION (POWDER)	774-03	CHROME PLATING ROOM - IN FRONT OF TANK #12	01-25-91 08:50				
44-04	¾"φ HARD JOINT	774-04	CHROME PLATING ROOM - IN FRONT OF TANK #12	01-25-91 08:55				
44-05	FLOOR COVERING	774-05	CLEANING ROOM - NEXT TO TANK #41	01-25-91 09:10				
44-06	1"φ PIPE INSULATION (POWDER)	774-06	ORNAMENTAL PLATING ROOM - AT END OF TANK #25	01-25-91 09:21				
44-07	1"φ HARD JOINT	774-07	ORNAMENTAL PLATING ROOM - AT END OF TANK #25	01-25-91 09:29				
44-08	ROOF MATERIAL	774-08	ROOF - NEAR ACCESS LADDER	01-25-91 10:25				
44-09	ROOF FLASHING	774-09	ROOF - NEAR CENTER OF RIGHT WALL	01-25-91 10:33				
44-10	ROOF EQUIPMENT FLASHING	774-10	ROOF - NEAR CENTER OF LEFT WALL AT SCRUBBER DUCT	01-25-91 10:39				

Released By (Signature)	Date Released	Delivery Method	Received By (Signature)	Co./Agency Affiliation	Date Received	Condition Noted

APPENDIX 4

Cost Estimates

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

SHEET 1 OF 6

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify) ____

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
ASBESTOS REMOVAL								
STEAM LINE ON OUTSIDE OF BUILDING	20	LF	$12.00	$ 240	$24.00	$ 480		$ 720
ROOFING MATERIAL	2,625	SF	$ 0.60	$1,575	$ 2.40	$6,300		$7,875
ASBESTOS REMOVAL = SUBTOTAL								$8,595

S/N 0105-LF-010-1335

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
INSTALLATION								
INSTALL CIRCUIT TO 600A PANEL	1	LS	$3,774		$2,428			$ 6,202
SUSPENSION BRIDGE FOR CONDUIT	1	EA	$ 360	$ 360	$ 840	$ 840		$ 1,200
SUPPORT BEAMS FOR CONDUIT	3	EA	$ 60	$ 180	$ 340	$1,020		$ 1,200
RELOCATE 2" STEAM LINE	150	LF	$16.63	$2,495	$22.19	$3,328		$ 5,823
INSTALLATION SUBTOTAL								$14,425

S/N 0105-LF-010-1335

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
DEMOLITION								
CONDUIT								
3/4" C	2,150	LF			$ 2.70			$5,805
1 1/2" C	200	LF			$ 4.39			$ 878
3"-4" C	200	LF			$10.98			$2,196
1" C	980	LF			$ 3.72			$3,646
1/0 COPPER CABLE BUS	18	CLF			$ 3.60			$ 65
600 MCM COPPER CABLE BUS	15	CLF			$ 3.60			$ 54
600A MCC SECTION	1	EA			$600			$ 600
WIREWAY								
12"x12"	10	LF			$24.00			$ 240
6"x6"	35	LF			$14.00			$ 490
24"x18"x6" JUNCTION BOX	1	EA			$65.00			$ 65
FIRE ALARM PULLBOX	1	EA			$36.00			$ 36

S/N 0105-LF-010-1335

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
DEMOLITION								
LIGHTS								
HIGH PRESSURE SODIUM HIGHBAY	6	EA			$108.00			$ 648
HIGH PRESSURE SODIUM WALLPACKS	3	EA			$ 60.00			$ 180
FLUORESCENT	8	EA			$ 48.00			$ 384
30A DISCONNECT	16	EA			$ 76.00			$1,216
60A DISCONNECT	3	EA			$104.00			$ 312
200A, 100A, 125A PANELBOARDS	3	EA			$450.00			$1,350
STARTER-WALL MOUNTED	2	EA			$ 96.00			$ 192
CABLE BUS - 1/0	1,800	LF			$ 3.60			$6,480
BUS BARS - 4x1/4x3	150	LF			$ 35.00			$5,250
BUS BARS - 4x1/4x4	60	LF			$ 41.00			$2,460

S/N 0105-LF-010-1335

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

SHEET 5 OF 6

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
DEMOLITION								
DISMANTLING & CLEANING TANKS	40	EA			$ 360.00			$ 14,400
FUME HOODS & DUCTS INSIDE	30	EA			$ 360.00			$ 10,800
DUCTWORK & FANS ON ROOF	15	EA			$ 240.00			$ 3,600
MONORAILS & BEAMS	500	LF			$ 5.23			$ 2,615
MISCELLANEOUS ITEMS					$6,000.00			$ 6,000
PIPING	500	LF			$ 4.80			$ 2,400
HYDRO-SAND BLASTING WALLS, ETC.	9,500	SF			$ 3.60			$ 34,200
VACUUMING DEBRIS	8	HR			$ 180.00			$ 1,440
CRANE RENTAL	8	HR			$ 120.00			$ 960
LIFT TRUCK RENTAL	16	HR			$ 60.00			$ 960
DISPOSAL OF ALL MATERIALS AS HAZARDOUS WASTE	65	TON			$ 360.00			$ 23,400
TRANSPORTATION TO DISPOSAL SITE	5	LOAD			$ 660.00			$ 3,300
DEMOLITION OF EMPTY BUILDING	44,550	CF			$ 0.40			$ 17,820
DISPOSAL OF BUILDING MATERIALS	250	CY			$ 45.00			$ 11,250
DEMOLITION SUBTOTAL								$165,692

S/N 0105-LF-010-1335

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify) ____

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
ASBESTOS REMOVAL SUBTOTAL								$ 8,595
INSTALLATION SUBTOTAL								$ 14,425
DEMOLITION SUBTOTAL								$165,692
TOTAL CONSTRUCTION								$188,712
ADDITIONAL TESTING BY CONTRACTOR								$ 20,000
TOTAL PROJECT COST								$208,712

S/N 0105-LF-010-1335

NAVFAC 11013/7 (1-78)
Supersedes NAVDOCKS 2417 and 2417A

COST ESTIMATE

DATE PREPARED: 4-16-91

ACTIVITY AND LOCATION: CHARLESTON NAVAL SHIPYARD

CONSTRUCTION CONTRACT NO.:

IDENTIFICATION NUMBER:

PROJECT TITLE: ENVIRONMENTAL STUDY-BUILDING 44 DEMOLITION

ESTIMATED BY: DAVIS & FLOYD, INC.

CATEGORY CODE NUMBER:

STATUS OF DESIGN: ☑ PED ☐ 30% ☐ 100% ☐ FINAL ☐ Other (Specify)

JOB ORDER NUMBER:

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
ASBESTOS REMOVAL SUBTOTAL								$ 8,595
INSTALLATION SUBTOTAL								$ 14,425
DEMOLITION SUBTOTAL								$165,692
TOTAL CONSTRUCTION								$188,712
ADDITIONAL TESTING BY CONTRACTOR								$ 20,000
TOTAL PROJECT COST								$208,712

S/N 0105-LF-010-1335

APPENDIX P

SUBCONTRACT LABORATORY QA/QC PLAN

Will be submitted when a laboratory is selected.

APPENDIX Q

RESUMES OF KEY PROJECT PERSONNEL

WILLIAM D. BACKUS, RG, CHMM
GEOLOGIST

EDUCATION: B.S., Geology, Memphis State, 1985
A.S., Calculus, Shelby State, 1983

CERTIFICATION: 1991, Registered Geologist
1991, Certified Hazardous Materials Manager

EXPERIENCE:

- Mr. Backus has a diverse background in the management, design and implementation of geophysical techniques at uncontrolled hazardous waste sites.

- Project geologist and author of an RFI Work Plan to investigate a Naval Weapons Industrial Reserve Plant. SWMUs investigated include a permitted OB/OD in operation since 1942, several pink water treatment ponds receiving various explosive fuel wastes including: triamino-trinitro-benzene (TATB), trichloro-trinitro-benzene (TCTNB), trichlorobenzene (TB), toluene, ammonium nitrate, and ammonium perchlorate. Several SWMUs required UXO screening prior to intrusive field activities.

- Managed the site investigation and multi-million dollar CERCLA removal at a wood treating facility involving creosote, PCP, and CCA wastes. Field tested a new immunoassay technique to screen soil samples for PCP content.

- Project geologist and author of an RFI Work Plan to investigate a Naval Air Station in western Tennessee. SWMUs to investigate include a Firefighting Training Area, numerous UST locations including : AVGAS, JP-4, Diesel, Gasoline, and No. 2 Fuel Oil., a pesticide storage area, several plating shops, and two closed landfills.

- Managed the immediate removal and disposal of chlorinated pesticide contaminated soil and debris from two industrial sites in the Carolinas. Both projects were completed in less than two months to comply with the prohibition variance for third 3rd wastes dated May 08, 1992 and 1993. Each project was enhanced by the utilization of a unique chloride screening method calibrated statistically to yield total HOC concentration.

HENRY H. BEIRO
SENIOR GEOLOGIST

EDUCATION: B.S., Geology, 1981
B.S., Biology, 1986

CERTIFICATION: 1989, Professional Geologist

EXPERIENCE:

- Completed a $1.5 million project at the Y-12 weapons plant in Oak Ridge, TN involving soil borings, groundwater well installation, and sampling.

- Review and writing Quality Assurance/Quality Control documents, work plans and field sampling plans for military installations in the US with Martin Marietta Energy System's Hazardous Waste Remedial Action Program (HAZWRAP).

- Designed the Tuskeegee, AL Landfill, installed monitoring wells and trained operators.

- Conducted and managed field gas chromatography for soil gas investigations, the most recent was Phelps Collins ANG, Alpena, MI in October 1991.

- Managed and supervised core drilling, rotary drilling, auger drilling and churn drilling operations at various sites.

MARK E. BOWERS, CHEMIST

EDUCATION: M.S., Environmental Pollution Control, The Pennsylvania State University/1988
B.A., Chemistry, Magna Cum Laude, University of North Carolina - Wilmington/1986

CERTIFICATION: Industrial Hygienist in Training, American Board of Industrial Hygiene

EXPERIENCE:

- Performed data validation following EPA Laboratory Data Validation Functional Guidelines for Evaluating Organics and Inorganics Analysis and EPA Precision and Accuracy Statements for alternative analytical methods.

- Developed and implemented Quality Assurance Project Plans (QAPPs) for NPL Site RI/FS in Kentucky, South Carolina, Rhode Island and Tennessee.

- Developed QAPPs for numerous projects under EnSafe's joint venture contract with the Southern Division of the Naval Facilities Engineering Command Comprehensive Long-Term Environmental Action Navy (CLEAN) program (Maryland, Virginia, Tennessee, and Texas).

- Conducted analytical laboratory QA audits as part of the CLEAN program subcontractor evaluation process.

- Developed QAPPs for RCRA and State driven site investigations in Arkansas, Rhode Island and Arizona.

- Designed sampling and analytical program dealing with leachable soil contaminants (oils and solvent) at PA hazardous waste site to establish rational approach to establishing remedial objectives based on contaminant fate and transport characteristics.

- Drafted Health and Safety Plans for site investigations in conjunction with an NPL site in Kentucky, and numerous hazardous materials/waste sites in Pennsylvania, Arizona, Maryland, Texas, and Tennessee.

- Performed Baseline Risk Assessments and Risk-Based Remedial Goals assessments for Federal, State and voluntary action hazardous waste sites.

- Developed Baseline Risk Assessments (Human Health and Ecological aspects) for two NPL sites in Kentucky.

- Assisted in the Development of Baseline and Post-Remedial Risk Assessments for NPL sites in South Carolina and Tennessee.

- Performed soil sampling at pesticide contaminated sites in Arizona, Missouri, South Carolina and Florida.

- Coordinated and supervised the remediation of two pesticide-contaminated hazardous waste sites (total cost $2 million +).

- Task Order Manager for CLEAN program (DERA fund) site investigation at leaking UST site.

- Employed as Project Manager/Environmental Scientist conducting pre-conveyance environmental audits, asbestos-containing materials surveys, soil and groundwater contamination investigations, supervising soil remediation projects, and preparing project proposals including budgets and schedules.

- Coordinated and supervised the closure of underground storage tank systems including 'Special Waste' disposal operations.

- Designed and conducted industrial hygiene testing programs for industrial clients in Mississippi, Arkansas, and Tennessee.

BENJAMIN J. BRANTLEY,
GEOLOGIST

EDUCATION:	M.S., Geology, (Concentration in Geophysics) Memphis State/1990 B.S., Geology, Memphis State/1984
CERTIFICATION:	Registered Geologist TN (#1602)
AFFILIATIONS:	NGWA American Geophysical Union

EXPERIENCE:

- Project Geologist responsible for supervision of underground storage tank closures per the Tennessee Department of Environment and Conservation's UST Division Guidelines.

- Project Geologist for preparation and implementation of Environmental Assessment Plans and Environmental Assessment Reports for Tennessee Department of Environment and Conservation, Division of UST and the Texas Water Commission.

- Responsible for numerous "preconveyance" Phase I environmental audits to determine potential presence of hazardous substances at sites under consideration for commercial and/or residential sale or development.

- Conducted numerous Phase II and Phase III Preliminary Contamination Assessments.

- Project Geologist for Site Investigation of aluminum recycling plant.

- Investigation involved evaluation of potential sources and pathways responsible for non complaint discharge levels of chlorides and ammonia in the plant's stormwater. Alternative corrective action measures were also evaluated.

M. CHRISTINE DHORITY,
CHEMIST

EDUCATION: **B.S., Chemistry, 1992**

CERTIFICATION:

EXPERIENCE: **Quality Assurance**

Mrs. Dhority is a chemist knowledgeable in analytical methods, data quality objectives and quality assurance programs. She is experienced in analytical and technical data evaluation and validation as defined under the Environmental Protection Agency's (EPA) Contract Laboratory Program, the EPA Office of Solid Waste and Emergency Response (OSWER) Test Methods for Evaluating Soild Waste (SW-846), and the Navy Energy and Environmental Support Activity. Her experience at EnSafe includes the following:

- Developed Quality Assurance Project Plan for Michie Dump Site (W.R. Grace), Michie, TN.
- Provided data evaluation, validation, and quality assurance guidance for several projects including:

  NWIRP, McGregor, TX
  NAS Belle Chase, New Orleans, LA
  NAS Chase Field, Beeville, TX
  Naval Surface Warfare Center, Indian Head, MD
  NAS Memphis, TN
  Norfolk Steel, Division of Birmingham Steel

- Assisted in development of CLEAN Comprehensive Quality Assurance Plan, SOUTHDIVNAVFACENCOM.

BARTON T. DOUGLAS,
GEOLOGIST

EDUCATION: M.S., Geology, 1990
B.S., Geology, 1986

EXPERIENCE:

- Designed and implemented a hydrologic investigation of TCE contamination in the municipal water supply of Douglas, MI.
- Conducted aquifer pumping tests and slug tests on sites in Millington, TN, Indianapolis, IN, and an NPL site in Fairfax, SC.
- Project manager for the removal and remediation of two leaking underground storage tanks at an auto maintenance facility in Memphis, TN.
- Assisted in the design and construction of a groundwater remediation system at the TCE contaminated site in Millington, TN. Tasks included placement and installation of fourteen remediation wells.
- Participated in an environmental audit of a storage facility in Memphis, TN.
- Involved in the installation and sampling of numerous groundwater monitoring wells on NPL sites in western Tennessee.

DAVID H. FELTER
REGISTERED GEOLOGIST

EDUCATION: B.S., Geology, Rensselaer Polytechnic Institute, 1983

CERTIFICATION: 1992, Registered Geologist

EXPERIENCE:

- Project geologist/project manager for over 85 Site Inspection, Preliminary Assessment, Expanded Site Inspection, and Hazard Ranking System reports including management of 10 HRS packages for Navy Installations.

- Project geologist responsible for the installation of six deep and six shallow monitoring wells and eleven vapor probes for the RI/FS of the Brantley Landfill USEPA Superfund Site.

- Project geologist for the installation of a total of 41 groundwater monitoring wells in both consolidated and unconsolidated materials. Experience with air hammer, air rotary, water rotary, coring, and augering techniques.

- Well installations include: PVC and stainless steel, two and four inch diameter, flushmounted and stickup, with and without secondary surficial casing, and open hole completions.

- Project geologist responsible for the implementation of an EAP and generation of the EAR for tank (t-301) at NAS Memphis. Provided oversight for a groundwater investigation and contaminated soil removal at a boiler plant in Georgia.

- Geologist responsible for generation of section E - Groundwater Monitoring Program for the Part B Application for WPNSTA Yorktown.

- Geologist responsible for the design of over 100 temporary and permanent, shallow and deep monitoring wells, aquifer test wells, and clustered piezometers for an RFI at NWIRP Dallas.

DAVID W. FUEHRER,
GEOLOGIST

EDUCATION: M.S., Geology, Bowling Green State University/1981
B.A., Geology, Knox College/1979

CERTIFICATION: Registered Professional Geologist TN #0679
Registered Professional Geologist AR #624

EXPERIENCE:

- Generated 19 exploration and drilling prospects in five offshore areas in the Gulf of Mexico and created five regional geologic studies in the Texas Gulf Coast Basin.

- Co-authored research and reports for the work plans on three Superfund sites in Kentucky and Tennessee.

- Completed Phase I Audits at a number of commercial and industrial sites in Tennessee and Mississippi.

- Responsible for geologic, geo-technical and hydrogeologic investigations required for permitting at a planned hazardous waste disposal facility.

- Involved in the construction and sampling of groundwater monitoring wells in eastern Tennessee.

- Conducted Phase II Audits involving drilling and sampling for seven clients in five states.

- Supervised the installation of groundwater monitoring wells and participated in the sampling of those wells at a Superfund site in western Tennessee.

- Authored one work plan and contributed to other work plans and projects for U.S. Navy "CLEAN" investigations.

GINNY L. GRAY,
GEOLOGIST

EDUCATION: B.A., Geology cum Laude Austin Peay State University/1987

CERTIFICATION: Professional Geologist, TN

EXPERIENCE:

- On the Chase Site in Douglas, MI, Ms. Gray implemented a field sampling protocol to identify levels of PCBs and Chromium for a contractor bid package.

- Conducted land burial site investigation at Oak Ridge National Laboratory to monitor for prediction and extent of transmission of radionuclides.

- Prepared a feasibility study for Open Burning/Open Detonation Part B RCRA Permit at NAS Key West.

- Prepared a Part B RCRA Permit and a Hazardous Waste Management Plan for NAS Oceana.

- Sampled groundwater monitoring wells for hazardous substance contamination and supervised well drilling operations at Memphis, Tennessee state Superfund site.

- Conducted continuing investigation of steel mini- mill "fluff" dump in Virginia to determine the areal and vertical extent of contamination by a listed hazardous waste. This investigation included preparation of remedial action proposals and their respective feasibilities.

- Conducted preliminary assessment of DRMO storage yard at Naval Air Station Pensacola for hazardous waste contamination.

- Responsible for design and implementation of various "preconveyance" environmental audits to determine potential soil contamination at various sites being considered for commercial and/or residential development.

- Developed a Hazard Communication Program for the City of Memphis Public Works Division. These programs required compliance surveys, development of compliance manuals, as well as coordination with city officials.

- Conducted remedial investigations at facilities for sites with potential soil and/or groundwater contamination involving pesticides, chlorinated solvents, and petroleum products.

- Prepared closure plans for several hazardous waste storage yards at Naval Base Norfolk, NAS Jacksonville, and Naval Air Station Oceana.

- Field supervision and implementation of numerous underground storage tank removal investigations. Field assessments include soil sampling and/or monitoring well installation with groundwater sampling.

- Site Manager for two (CERCLA) Superfund Sites in Ohio and McLean Counties, Kentucky. Responsible for negotiations with USEPA, RI/FS implementation, budgeting, resource allocation, etc.

- Conducted sampling of drums at pesticide spill site. Responsible for selecting removal contractor and supervised off site disposal to permitted hazardous waste facility.

- Performed karst investigation at western Kentucky Superfund site to determine potential contaminant migration pathways and turbulent flow aquifer characteristics on-site.

GERALD T. HAVERKOST,
GEOLOGIST

EDUCATION: B.S., Geology, University of Kentucky, 1989

CERTIFICATION: Registered Geologist, TN 1762

EXPERIENCE:

- Site Geologist for a chlorinated solvent contaminated TN state Superfund site. Tasks included work plan design, field supervision, data reduction, and report generation.

- Site Geologist for a CERCLA RI/FS of a former pesticide formulating facility in South Carolina. Tasks included implementation of a field sampling plan, data reduction, and report generation.

- Prepared a QA/QC plan necessary for conducting soil/groundwater investigations under provisions of the Mississippi Groundwater Protection Trust Fund.

- Site Geologist for a chlorinated solvent contaminated industrial facility in Indiana. Tasks included monitoring well installations and in-situ soil gas monitoring.

- Assistant Geologist for a hydrogeologic investigation conducted on a chlorinated solvent contaminated site in Michigan. Field investigation included deep soil borings, monitoring well installations, and report generation.

- Developed and implemented closures at numerous UST sites. Tasks included conducting assessments of leaking USTs and supervision of corrective actions.

- Responsible for conducting "preconveyance" investigations to evaluate potential soil/groundwater contamination at sites being considered for commercial development.

- Served as a staff geologist for an engineering firm in Marietta, GA. Responsibilities included project management and assistance with numerous drilling projects.

- Prepared work plans for conducting RCRA Facility Investigations (RFI) at U.S. Naval Bases.

CONWAY TODD HUGHES III
GEOLOGIST

EDUCATION: M.S. Geology, Memphis State University, 1982
B.S. Geology/Earth Science, Middle Tennessee State University, 1980

CERTIFICATION: Registered Geologist, Tennessee

EXPERIENCE:

- Conducted a prepurchase Phase 1 and Phase 2 environmental assessments at multiple industrial plants owned by ABB Sprout-Bauer located in the United States and Canada for Machinenfabrik Andritz Actiengesellschaft.

- State Superfund site involving contamination with various hazardous substances at the Stauffer Chemical Plant in Mt. Pleasant, TN.

- Seven years conducting geologic and hydrogeologic investigations at solid and hazardous waste sites in Tennessee. Reviewed geologic and hydrogeologic site conditions and data for siting and operational permit or closure of sanitary and industrial landfills and hazardous waste treatment storage and investigations, well installations and sampling. Prepared reports summarizing site conditions and recommending site usage.

- National Priority List involving groundwater contamination of a regional aquifer at the Carrier Plant in Collierville, TN.

- National Priority List site involving groundwater contamination with heavy metals at the Murray Ohio Site in Lawrenceburg, TN.

- State Superfund site involving groundwater contaminated with industrial solvents at the Genesco Site in Brentwood, TN.

- National Priority List site involving groundwater contaminated by pesticides at the Arlington Blending Site in Arlington, TN.

- State Superfund involving creosote contamination at the Wrigley Charcoal Plant in Lyles, TN.
- State Superfund site involving removal of PCB contaminated soil at the Modine Plant in Lawrenceburg, TN.
- State Superfund site involving groundwater contaminated with industrial solvents at the Heil-Quaker Plant in Lewisburg, TN.
- State Superfund site involving groundwater contaminated with solvents at the Sperry-Univac Site in Bristol, TN.
- Conducted preliminary site evaluations of the Newsome Station and Spicewood Hollow potential landfill sites at the Metro Nashville Landfill sighting.
- Conducted various activities including preliminary and final geologic and hydrogeologic assessments of potential landfill sites including soil classification and segregation, monitoring well installation, monitoring system evaluation for numerous counties, municipalities, industries and commercial landfills in Middle Tennessee.

ANDREW C. KIM,
CHEMIST

EDUCATION: B.S. Chemistry, Rutgers University, The State University of New Jersey/1989

A.S. Engineering Science, Bergen Community College/1985

TRAINING: OSHA 40 Hour Health and Safety Training

EXPERIENCE:

- Developed and implemented Quality Assurance Project Plans (QAPPs) and performed the role of Quality Assurance (QA) Manager for a number of projects under the EnSafe/Allen & Hoshall CLEAN program with the Southern Division of the Naval Facilities Engineering Command Comprehensive Long-Term Environmental Action Navy program. The QA Manager is responsible for overseeing proper project performance in accordance with the requirements stated under the Naval Energy and Environmental Support Activity (NEESA).

- Performed the role of QA Manager for projects in accordance to the requirements stated under the following regions:
  - Environmental Protection Agency's Environmental Compliance Branch Region IV,
  - Environmental Protection Agency Region I,
  - State of New Jersey Department of Environmental Protection and Energy.

- Proficient in the area of analytical and technical data evaluation and validation under the requirements of the following agencies:
  - Environmental Protection Agency's Contract Laboratory Program, Statement of Work for Organic and Inorganic Analysis,
  - Environmental Protection Agency's Contract Laboratory Program, National Functional Guidelines for Organic and Inorganic Data Review,
  - EPA Office of Solid Waste and Emergency Response (OSWER) - Test Methods for Evaluating Solid Waste (SW-846)

- In addition to the methodologies outlined under the Environmental Protection Agency - Methods of Chemical Analyses of Water and Waste, OSWER Test Methods for Evaluating Solid Waste (SW-846), Standard Method for the Examination of Water and Wastewater, the EPA Physical and Chemical Methods Branch - Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water, EPA Regulations on Test Procedures for the Analysis of Pollutants as defined under 40 CFR 136, and the American Society for Testing and Materials and Standard Methods.

- Trained two years with Buckman Laboratories, Inc. as a Quality Control Chemist. Received laboratory experience with analytical instrumentation and in quality control measures.

- Trained four years in an analytical testing laboratory capacity. Established analytical training with methodologies and instrumentations. Examples of such instrumentation experiences are with a GC/FID & PID, GC/ECD, HPLCs, UV/IR Spectroscopy, and a number of wet chemistry methodologies.

JOSEPH R. MATTHEWS, GEOLOGIST

EDUCATION: M.S., Geology, Memphis State University/1989
B.S., Geology, University of Tennessee at Chattanooga/1985

CERTIFICATION: Registered Professional Geologist TN1112

EXPERIENCE:

- **Project Manager/Geologist** developed RCRA Facility Investigations and directed field operations at Naval facilities. Investigated shallow subsurface and shallow aquifer systems to define contaminant migratory pathways and evaluate health risks. Data used to determine the proper worker protection for the demolition of a pesticide-contaminated storage facility.

- **Project Manager** developed and implemented UST closures in compliance with local, state and federal (RCRA) laws and regulations. Conducted assessments of leaking UST sites and completed corrective actions for petroleum hydrocarbon contaminated soil and groundwater systems. Completed UST- related projects in Tennessee, Mississippi, Missouri, Alabama, Indiana, Texas, and Kentucky.

- **Project Geologist** designed and directed field activities of a Site Inspection of a land disposal facility for the US Navy. Prepared a Site Inspection report under CERCLA protocol for the preparation of a Hazard Ranking Score of the facility.

- **Project Geologist** conducted state and private industry site investigations: assessing geohydrologic conditions, determined nature and extent of site contamination, dealt with organo-pesticides, chlorinated hydrocarbons, non-halogenated hydrocarbons, chlorides, cyanides and PCB's.

- **Project Coordinator** overseeing the emergency remedial response action at a PCB spill site in Akron, Ohio. Activities included removal of PCB-contaminated soils, oil-cooled capacitors containing PCB dielectric fluids and decontamination of PCB contaminated concrete floors and walls. Designed and implemented sampling scheme for verification of cleanup of PCB contaminated areas.

- **Geologist** supervised drilling operations, installed monitoring wells, monitored health and safety compliance, and collected soil and groundwater samples following CLP protocol.

- **Geologist** investigating a proposed hazardous waste incinerator site: characterized stratigraphy, geologic structure and geohydrologic conditions.

- **Assistant Geologist** for a long-term groundwater monitoring program at a Tennessee State Superfund site: quarterly groundwater sampling under CLP protocol, collected and reduced groundwater data and prepared piezometric maps and geologic cross-section delineating the distribution of a chlorinated hydrocarbon plume in a multiple aquifer system.

- **Investigator** conducting Phase I environmental site assessments and environmental compliance audits consistent with the "due diligence" clause of CERCLA. Reviewed facility operation for compliance with local, state and federal environmental laws and regulations. Identified potential environmental compliance problems and estimated cost for corrective action. Conducted audits in close cooperation with investors, legal counsel, and lending institutions and their attorneys. Designed and conducted Phase II audit investigations where subsurface and groundwater contamination was indicated.

- **Field Coordinator** on hazardous materials abatement sites: monitoring health and safety compliance and consulting.

GREG T. PIERCE, GEOLOGIST

EDUCATION: B.S. Western Kentucky University/1991

EXPERIENCE:

- Co-authored RCRA Facility Investigation Plan (RFI) and Verification Investigation Plan (VI) for the Naval Explosive Ordnance Disposal Technical Center (NEODTC), Stump Neck Annex, Indian Head, Maryland. The project dealt with the investigation of contaminated soils, surface water and groundwater. The contaminates of concern are 40 CFR 264 Appendix IX metals, semi-volatiles, volatiles and explosive compounds, such as RDX, HMX, and TNT.

- Authored a groundwater monitoring program for an industrial site in Memphis, Tennessee. The contaminates of concern are trichloroethene, tetrachloroethylene, cyanide, and metals.

- Performed an investigation of macropores and their contribution to sinkhole collapse and contaminant migration in karst terrain.

- Versed in groundwater computer modeling.

- Performed microgravity survey for the detection of cave passages.

- Assisted in dye traces for the delineation of drainage basins.

- Assisted in the installation of monitoring wells, and piezometers for a groundwater remedial investigation.

- Assisted in the quarterly sampling of over 40 monitoring wells under CLP protocol at a Tennessee Stated Superfund site.

- Assisted in conducting Phase I environmental compliance audits.

- Assisted in conducting Phase II audit investigations to determine surface and groundwater contamination.

- Assisted in the quarterly groundwater sampling under CLP protocol at a pesticide processing facility in Fairfax, South Carolina. The contaminants of concern are semi-volatiles, volatiles, metals, and organo-pesticides.

JAMES N. SPEAKMAN, Ph.D., P.E.
VICE-PRESIDENT OF ENGINEERING

Education: Ph.D., Environmental and Water Resources Engineering, Vanderbilt University/1971
M.S., Sanitary Engineering, Vanderbilt University/1968
B.S., Civil Engineering, Tennessee Technological University/1966

Certifications: Professional Engineer

Experience:

- Manager of hazardous waste facility design projects for container storage facilities in South Carolina, Florida, Texas, and Tennessee.

- Manager of tank storage design and permitting projects at two (2) U. S. Navy torpedo fuel facilities. Project involved coordinated closure of existing tanks under Federal and state (VA and SC) regulations.

- Managed five (5) open-end hazardous waste compliance contracts for NAVFACENGCOM; four (4) for SOUTHDIV and one (1) for LANTDIV. Projects included development of hazardous waste management plans, hazardous material spill prevention control and countermeasure plans, comprehensive hazardous waste and hazardous materials surveys and preparation of fifteen permanent status permit applications. He prepared the first RCRA Part B Permit application submitted by the U.S. Navy.

- Directed underground tank assessment/closure/removal/remediation projects involving benzene, acetone, toluene, naptha, and petroleum fuels at Santa Anna, CA; Charleston, SC; Lawrenceburg and Memphis, TN; Dallas, TX, and Yorktown, VA. Projects involved removal of as many as six (6) tanks concurrently.

- Managed site remediation projects and hazardous waste facility closures involving heavy metals, volatile organics and PCBs. Developed remediation plans and had responsible charge of their implementation.

- Directed Resource Conservation and Recovery Act (RCRA) Permanent Status Permit applications for the Lake City (Independence, MO), Holston (Kingsport, TN) and Milan, TN Army Ammunition Plants. Those facilities operate multiple hazardous waste storage and treatment facilities, i.e., container storage buildings, surface impoundments, waste piles, incinerators, and treatment units; handling corrosive, reactive (including explosive), ignitable and toxic wastes.

PAUL V. STODDARD, C.P.G.
VICE PRESIDENT, GEOLOGICAL SERVICES

EDUCATION: M.S., Geology, Memphis State University/1983
B.S., Geology, Memphis State University/1982
B.S., Biology, Memphis State University/1980

CERTIFICATION: Certified Professional Geologist

EXPERIENCE:

- Generated stratigraphic correlations of upper Cretaceous and Tertiary trends of South Texas with concentration in the Wilcox and Frio formations. Responsible for regional correlations of E-logs, preparation of stratigraphic cross sections, development and updating of structure maps, and well spotting and digitizing.

- Conducted remedial site investigations at facilities for sites with potential soil and/or groundwater contamination involving chlorinated hydrocarbons and petroleum products. Field assessments included in-situ monitoring of organic vapors utilizing an organic vapor detector and/or a scanning infrared spectrophotometer.

- Responsible for the design and implementation of "preconveyance" investigations to determine potential soil contamination at various sites being considered for commercial development.

- Field supervision and implementation of closure plans for hazardous waste facilities at Charleston, SC Naval Shipyard. Tasks included removal of hazardous waste inventories, decontamination of tanks, confirmation sampling of decontamination solutions and soil sampling at container storage compounds operated by the Shipyard and Defense Reutilization and Marketing Office.

- Sampled groundwater monitoring wells for hazardous substance contamination and supervised well drillers at Shelby County, TN state Superfund site.

- Conducted a study of pesticide contamination in groundwater at an industrial facility in Missouri. Field Investigation included soil boring, monitoring well installation, determination of hydraulic gradients, data reduction and analyses, and report generation.

- Implemented groundwater investigation for photosensitive hazardous substance contamination at NPL site.

- Field supervision and implementation of closure plans for removal of underground waste oil storage tanks and investigation of potential contamination in soils and groundwater from tank releases.

- Field supervision and implementation of sampling plan for hazardous waste facilities at NAS Memphis. Task included Level B inspection of former waste plating treatment storm sewer, and the sampling of soils associated with defective joints. The task also included the sampling of a former salvage yard for petroleum hydrocarbons and lead.

- Field supervision and implementation of underground storage tank removal investigations. Field assessments include soil sampling and/or monitoring well installation with groundwater sampling and assessment of hydrogeologic conditions.

- Project geologist for interior survey of 120 acre underground room and pillar mine. Additional tasks included surface investigation of karst features, monitoring well installation, interpretation of borehole geophysics, and subsequent groundwater sampling and data reduction.

- Project geologist for hydrogeologic assessment of RCRA facilities. Tasks include site selection and installation of groundwater monitoring networks, slug tests, and subsequent data evaluation.

- Project geologist for MCAS Cherry Point, RFI. Tasks included design and implementation of Field Sampling Plan, including soil borings, monitoring well installation, groundwater sampling, slug tests, hydrogeologic characterization -- including diurnal and tidal influences on the shallow aquifer and subsequent data reduction and report generation.

- Project geologist for hydrogeologic assessment of a proposed TN state Superfund site. Investigation included step drawdown and constant rate aquifer pump test for design and installation of a groundwater treatment system.

- Project manager for CERCLA Remedial Investigation/Feasibility Study for a former pesticide manufacturing facility. Tasks included the design and implementation of geologic/hydrogeologic assessment for volatile organic and pesticide contamination, subsequent data reduction, and report generation. Project management included cost tracking, scheduling, and continued regulatory compliance (i.e. Administrative Order).

- Project manager for CERCLA RI/FS for an industrial manufacturing facility. Related tasks included the design and implementation of geologic/hydrogeologic assessments for chlorinated solvent contamination in soils and groundwater. Investigation included monitor well installations, soil vapor extraction, borehole and surface geophysics, and a constant rate aquifer pump test, with subsequent data reduction and interpretation and RI report generation. Project management duties included community relations, maintaining data quality objectives, scheduling, waste disposal, and meeting Administrative Order Requirements.

- Supervised and directed remedial investigations (RI) per CERCLA requirements at multiple NPL sites, Region 3, Region 4, Region 5 and Region 6. Investigations included, but were not limited to, soil analyses, monitor and recovery well installation, sampling and analyses of groundwater, aquifer tests, borehole geophysics, surface geophysics and data interpretation, including preparation and presentation of assessment reports.

APPENDIX R

WELL CASING MATERIAL

Source: US Army Corps of Engineers. Leaching of metal pollutants from four well casings used for groundwater monitoring. September 1989.

Hewett, Alan D. Groundwater Well Review. Potential of Common Well Casing Materials to Influence Aqueos Metal Concentrations. Spring, 1992.

Southern Division Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) is committed to using only the most reliable methods to obtain the data used in its investigations. Therefore, SOUTHNAVFACENGCOM recommends the use of well casings made of Polyvinyl chloride (PVC) material for monitoring wells installed at NAS Cecil Field. After reviewing the literature, SOUTHNAVFACENGCOM has concluded that PVC is a superior well casing material when monitoring a plume consisting of both metals and organics. Attached are two recent publication supportive of SOUTHNAVFACENGCOM's position: "Influence of Casing Materials on Trace-Level Chemicals in Well Water" (Parker, 1990) and "Leaching of metal pollutants from four well casing used for ground-water monitoring" (Hewitt, 1989).

SOUTHNAVFACENGCOM requests USEPA consider the following information as required in the "Alternate Well Casing Material Justification" form.

1. The Data Quality Objectives (DQO) for the samples to be collected from wells with PVC casing per EPA/540/G-87/003., "Data Quality Objectives for Remedial Response Activities."

Response: The DQOs for the remedial investigation (RI) at Cecil Field are to provide information of sufficient quality to support risk assessment and feasibility study conclusions. The quality assurance and quality control (QA/QC) procedures are specified in the Sampling and Analysis Plan (SAP). Sample collection and accompanying QA/QC procedures are designed to meet USEPA level 4 criteria.

2. The anticipated compounds and their concentration range.

Response: The following is a list of the contaminants that exceeded an existing maximum contaminant level (MCL) and the highest contaminant concentration detected: Lead at 385 ug/l, Chromium at 425 ug/l, benzene at 4 ug/l, Trichloroethylene at 400 ug/l, and 1,1-Dichloroethane at 210 ug/l.

3. The anticipated residence time of the sample in the well and the aquifer's productivity.

Response: Each well will be purged immediately before the sample is collected. The anticipated residence time of the water prior to sampling should be less than twenty minutes. The surficial aquifer is estimated to have a transmissivity range of 0.05 to 3.93 m^2/day.

4. The reason for not using a hybrid well.

Response: SOUTHNAVFACENGCOM feels that PVC is the preferred material when sampling mixed waste plumes. Stainless steel may absorb or adsorb heavy metals such as lead, chromium and arsenic. Also, the cutting oils used in the manufacturing of stainless-steel riser and screen are difficult to remove. These oils, if not completely removed by the decontamination cleaning, may contaminate the well. Hybrid wells introduce additional problems, such as, the junction is usually a weak point subject to breakage or is a place for down-hole equipment to become ensnared.

5. Literature on adsorption/desorption characteristics of the compounds and elements of interest for the type of PVC to be used.

Response: Two reprints are attached that evaluate the sorptive characteristics of stainless steel and PVC. The study tilted "Influence of Casing Materials on Trace-level Chemicals in Well Water" (Parker, 1990), evaluated all the chemicals of concern identified in previous Cecil Field studies except benzene and 1,1-dichloroethane.

6. If an anticipated increase in thickness of the wall thickness will require a larger annular space.

Response: No change in the annular space is required.

7. The type of PVC to be used and if available the manufacturers specifications. And an assurance that the PVC to be used does not leach, mask, react or otherwise interfere with the contaminants being monitored within the limits of the DQO(s).

Response: The PVC will comply with American Society of Testing and Materials (ASTM) F480 and D1785.

SOUTHNAVFACENGCOM strongly believes that the quality of data obtained by using PVC well construction materials will be equal to or an improvement over the use of stainless steel as a general purpose well construction material.

DEPARTMENT OF THE ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, CORPS OF ENGINEERS
HANOVER, NEW HAMPSHIRE 03755-1290
February 25, 1991

Applied Research Branch

Ms. Peggy Lane
ABB Environmental Services
2571 Executive Center Circle, East
Suite 100
Tallahassee, Florida 32301

Dear Ms. Lane:

I have enclosed a copy of our journal article that compares the sorption of organics and metals by four well casing materials (PVC, PFTE, and stainless steel types 304 and 316). I have also included a more recent study that compares the leaching of metals from these materials; this study was conducted by Alan Hewitt. It is our opinion that since you are monitoring for both VOC's and metals that PVC is the best material to use in your monitoring wells, provided that you do not anticipate encountering an undiluted solvent of PVC. Stainless steel is not a good casing material to use when monitoring for metals. Also, stainless steel should not be placed in any environment that is corrosive. "The Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells," by Linda Aller et al. (1989, published by the National Water Well Association, Dublin, Ohio) has an excellent discussion on corrosion of steel products.

If you would like any additional questions answered, please do not hesitate to call me at 603-646-4393. Alan Hewitt can answer any questions on our metals studies. He can be reached at 603-646-4388.

I hope you find this material useful.

Sincerely,

Louise Parker

Louise V. Parker
Research Physical Scientist
Applied Research Branch

2 enclosures

Special Report 89-32

September 1989

US Army Corps
of Engineers
Cold Regions Research &
Engineering Laboratory

Leaching of metal pollutants from four well casings used for ground-water monitoring

Alan D. Hewitt

Prepared for
U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
REPORT CETHA-TE-CR-89186

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6a. NAME OF PERFORMING ORGANIZATION U.S. Army Cold Regions Research and Engineering Laboratory 6b. OFFICE SYMBOL (If applicable) CECRL	7a. NAME OF MONITORING ORGANIZATION U.S. Army Toxic and Hazardous Materials Agency
6c. ADDRESS (City, State, and ZIP Code) 72 Lyme Road Hanover, N.H. 03755-1290	7b. ADDRESS (City, State, and ZIP Code) Aberdeen Proving Ground Maryland 21010
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)

Leaching of Metal Pollutants From Four Well Casings Used for Ground-Water Monitoring

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Polytetrafluoroethylene (PTFE), polyvinylchloride (PVC), stainless steel 304 (SS 304) and stainless steel 316 (SS 316) well casings were tested for suitability for ground-water monitoring. A laboratory experiment, testing for the leaching of Ag, As, Ba, Cd, Cr, Hg, Pb, Se and Cu, was run in triplicate by exposing sections of the well casings to ground water for four periods ranging from 1 to 40 days. The results showed that PTFE did not leach any of the nine analytes studied, while SS 316 and PVC showed significant leaching of Cr, Cd and Pb; SS 316 also leached significant amounts of Ba and Cu. Stainless steel 304 showed significant leaching of Cr and Pb. In every case where contamination was observed, the release of metal analyte, when averaged over all of the exposure periods, was the greatest from either SS 304 or SS 316. Released contaminants were sorbed back onto the well casings in several cases.

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PREFACE

This report was prepared by Alan D. Hewitt, Research Chemist, Geochemical Sciences Branch, Research Division, U.S. Army Cold Regions and Research and Engineering Laboratory. This project was funded by the U.S. Army Toxic and Hazardous Materials Agency (R-90 Multi-analytical Services), Martin H. Stutz, project monitor.

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Leaching of Metal Pollutants From Four Well Casings Used for Ground-water Monitoring

ALAN D. HEWITT

INTRODUCTION

Ground-water monitoring requires the installation of conduits to transfer water to the surface for collection. Four commonly used well casings are made from 2-in. (5-cm) diameter polyvinylchloride (PVC), stainless steel 304 (SS 304), stainless steel 316 (SS 316) and polytetrafluoroethylene (PTFE) pipes. Representative sampling of ground water requires that materials employed in the saturated zone do not influence the concentration of analytes of interest.

Only a few studies have reported the influence of well-casing materials on the concentrations of inorganic substances in ground water during water quality analyses. Several studies have demonstrated that these materials (stainless steel, PVC and PTFE) sorb appreciable quantities of certain ionic species (Eichholz et al. 1965, Miller 1982, Hewitt 1989). Evidence also exists showing that metals are released into ground water from stainless steel and PVC pipes (Houghton and Berger 1984, Barcelona and Helfrich 1986, Hewitt 1989). The release of metal analytes by stainless steel has been associated with its corrosion, which in some instances has been observed to produce a hydrous iron precipitate (Barcelona and Helfrich 1986, Hewitt 1989).

Recently, a laboratory experiment was conducted testing the effects of ground-water composition on the well casings cited above (Hewitt 1989). In this experiment two concentrations of metals (As, Cd, Cr and Pb), pH and total organic carbon were introduced as ground-water solution variables. Results of this experiment indicated that PTFE was inert to the variables, whereas both PVC and stainless steel well casings were affected. These two materials leached and sorbed some of the metals introduced into the ground water. In addition, several stainless steel casing sections developed surface oxidation, which introduced a random source of variation by providing release mechanisms and active sites for sorption. PVC was a low-level source for Cd and provided sorption sites for Pb. Stainless steel 316 was a low-level source for Cd and provided sorption sites for As, Cr and Pb. Stainless steel 304 was also a low-level source for Cd and provided sorption sites for As and Pb. The extent of the sorption or release of metals was often influenced by the solution variables. This study concluded that the stainless steel casings were the least suitable for monitoring the metals studied (As, Cd, Cr and Pb) in the ground water solutions.

A concurrent study done at CRREL (Parker et al. 1989) looked at ground-water solutions spiked with organic compounds exposed to the same four well casings. In contrast to the results for metals, eight (cis and trans-1,2-dichloroethylene, m-nitrotoluene, trichloroethylene, chlorobenzene, o-,p- and m-dichlorobenzene) of the ten organic compounds studied sorbed more quickly and to a greater extent onto PTFE than PVC and did not sorb onto the stainless steels. The same results were obtained when the ground water was treated with 2.0 g NaCl/L to test for effects of ionic strength. These findings support the earlier work of Reynolds and Gillham (1985) who observed rapid sorption of tetrachloroethylene by PTFE well casing. They suggested that PTFE is the least desirable material for a well casing when organic compounds are monitored in ground water.

The results of these two recent CRREL studies (Hewitt 1989, Parker et al. 1989) and supporting evidence in the literature led to the suggestion that PVC may be the best compromise among these four well casings for monitoring ground water for both inorganic and organic analytes (Parker et al. 1988).

The objective of this study is to examine metal leaching characteristics of these four well-casing materials in ground water. Leaching studies that compare these four well casings have not been reported in the literature. The results of this experiment will determine which casings are the most or the least susceptible to leaching the metals. The analytes analyzed included all of the metals on the Environmental Protection Agency's priority pollutant list, along with copper.

MATERIALS AND METHODS

Materials

The PVC and stainless steel well casings were obtained from Johnson Well Screen, and the PTFE was obtained from MIP, Inc. All well casings were specifically manufactured for ground-water monitoring. The casings all had approximately a 5-cm inner-wall diameter and were cut in lengths of approximately 2 cm. The exact length of the rings depended on the wall thickness and diameter of the pipe because we wanted to maintain a constant surface area of 80 cm^2. Cut surfaces composed 17% of the area for the PTFE and PVC well casings and 9% for the stainless steels.

Precautions were taken during pipe milling to prevent exposure to grease, dirt, oil and solvents, and to avoid excessive handling. After milling, the individual well-casing rings were rinsed with deionized water (Millipore, Type 1) and air dried before being placed into the ground-water-filled sample containers. During rinsing we made no attempt to remove surface discoloration or ink on the pipes; we used them as we had received them from the manufacturer. This limited cleaning was consistent with commonly employed field protocols.* The well-casing sections were handled with plastic gloves and nylon forceps after milling. Two sections of the SS 316 pipe were not used because excessive surface rust had formed. In general the stainless steel well casings appeared to have developed more rust during the 9-month storage period than they had when first obtained. All experimental work was performed in class 100 cleanrooms.

Polypropylene jars (69 mm od × 62 mm height, 125 mL, Model 6185-E37, Thomas Scientific) served as the sample containers. The jars were soaked in a 10% v/v concentrated, redistilled HNO_3 (G. Fredrick Smith [GFS]) deionized water solution, then rinsed with and soaked for several days in deionized water prior to use. Other materials, such as the 7.5-mL sample aliquot bottles (polyethylene, Nagle), pipette tips (Eppendorf), and the 2-L glass bottles (reagent grade HNO_3 bottles, Baker), were cleaned similarly.

Test design

Tests for the release of metals from PVC, PTFE, SS 304 and SS 316 well casings were done in triplicate by exposing sections of each to ground water for periods of 1, 5, 20 and 40 days. Three sample containers with no well casings served as controls for each of the exposure periods. The containers with and without well casings were filled with 98 mL of ground water collected from a 76-m-deep domestic well system in Weatherfield, Vermont; 60 containers, 12 with a single section of each of the four well-casing candidates (12×4) and 12 controls, made up the experimental sample setup. The well-casing rings were submerged in the ground-water-filled sample containers creating a pipe-surface-area-to-aqueous-volume ratio of 0.82 cm^2/cm^3. This experimental design provides a surface-area-to-solution ratio similar to that of well casings in ground-water monitoring wells below the saturated zone; however, the ratio is much lower than that which exists for well screens.

Samples were prepared by transferring weighed amounts of ground water into each jar from a single 2-L glass bottle. The jars were selected randomly for the experiment because the ground water was transported in three separate 2-L glass bottles. The pH and conductivity of the ground water from all of the bottles was 7.8 and 2.40×10^{-2} mho/cm, respectively. Ground water collected from this source previously showed similar pH and conductivity levels (Hewitt 1989). While the well casings were exposed to the ground water, the jars were sealed with a cap and stored in the dark at 24°C. After the well-casing sections had been removed from the jars at the end of each time interval, 2 mL of concentrated HNO_3 (GFS) was added to the ground water to bring the pH below 1.0. Studies have shown that acidification below pH 1.5 is effective in preventing the loss of trace metals from natural waters (Subramanian et al. 1978). The acidified, ground-water-filled jars were recapped, hand-swirled for 10 seconds, then left at rest for at least 72 hours before we transferred a 5-mL aliquot to a 7.5-mL sample vial (polyethylene, Nagle) for the subsequent determination of Ag, As, Ba, Cd, Cu, Cr, Pb and Se.

The entire experimental setup was duplicated for the analysis of Hg, except that we determined Hg immediately after the ground-water-filled jar was acidified.

In a preliminary experiment, ground water stored in the polypropylene jars was spiked with

* Personal communication with Louise V. Parker, CRREL, 1989.

Cd, Cr and Pb to see if sorption of metals ions on the jar walls would interfere with the test results. These metal ions, added to the ground water and stored for 6 days in the sample jars, were recovered upon acidification (Table 1). The desorption of metal ions from container walls has been reported by Choa et al. (1968). For this preliminary test, 5.00 µg/L of Cd, Cr and Pb was allowed to sit in ground-water-filled jars (100 mL) for 6 days. Then we added 2 mL of concentrated HNO_3 (GFS), hand swirled the solution for 10 seconds, and removed a 5-mL aliquot. A second 5-mL aliquot was removed 72 hours later, following the same procedure. The results in Table 1 show that an average of 95% of the aqueous metal was recovered immediately after acidification, and aliquots removed 3 days later showed only 2% (not significant at the 95% confidence level) additional analyte recovery. Thus the metals either remained in the laboratory ground-water solution or were desorbed from the jar walls quickly upon acidification.

Table 1. Recovery of Cd, Cr and Pb (4.90 µg/L) from ground water stored in the sample jars and allowed to equilibrate for 6 days before being acidified with 2 mL of concentrated HNO_3.

	Acidification period			
	Less than 10 minutes		*72 hours*	
	*Amount * ~~added~~ (µg/L)*	*Percent recovered*	*Amount * ~~added~~ (µg/L)*	*Percent recovered*
Cd	4.65	94.9	4.72	96.3
	4.72	96.3	4.85	99.0
Cr	4.48	91.4	4.58	93.5
	4.48	91.4	4.69	95.7
Pb	4.93	100.2	4.72	96.3
	4.72	96.3	5.01	102.2
Average recovery	95.1%		97.2%	

* determined

Analysis

Silver, arsenic, barium, cadmium, copper, chromium and lead were determined by Graphite Furnace Atomic Absorption (GFAA) using a Perkin-Elmer (PE) model 403 Atomic Absorption Spectrophotometer (AAS) coupled with a PE model 2200 heated graphite atomizer. Instrumental procedures followed the general guidelines provided in the manufacturer's instrument manual (Perkin-Elmer 1981). Hand injections of either 20, 50 or 100 µL were employed for the analytes mentioned above.

For the determination of Se, a matrix modifier—0.015 mg Pd and 0.01 mg $Mg(NO_3)_2$—was added so that the charring temperature could be raised to 1200°C. Of this group, only As and Se determinations required deuterium background correction.

Mercury was determined by Cold Vapor Atomic Absorption (CVAA). We employed a 48-mL aliquot for the Hg determinations, following a modified Hatch and Ott (1968) procedure. Aliquots of 48 mL of ground water were reduced with 2 mL of 10% v/v stannous chloride and then sparged with Hg-free air. The reduced Hg vapor passed through a $Mg(ClO_4)_2$ water vapor trap into an optical cell designed to enhance detection (Tuncel and Ataman 1980). The optical cell was positioned in the light path of the PE model 403 AAS.

Mercury was determined the same day that well casings were removed from ground-water-filled jars to limit volatilization of Hg from solution (Coyne and Collins 1972, Lo and Wai 1975) and to avoid vapor contamination associated with storage in poly containers (Cragin 1979). All of the other metals were determined within 2 weeks after the last exposure period.

Analysis procedures were designed to achieve detection limits of 1% or less of the present domestic water quality levels set by the EPA (Table 2). Selenium, determined by graphite furnace, was the only metal with a detection limit slightly above this level (Table 2). Method Detection Limits (MDLs) were established following the procedure outlined in the Federal Register (1984) for the analysis of a sample in a given solution. The MDL estimate requires that a minimum of seven replicate determinations be made of an analyte concentration that is one to five times the estimated detection level.

Table 2. EPA interim primary drinking water quality levels (1983) and the method detection limits (MDL).

Metal	*EPA primary drinking water levels (µg/L)*	*MDL (µg/L)*
Ar	50	0.48
Ba	1000	2.4
Cd	10	0.059
Cu	1000	4.3
Cr	50	0.16
Pb	50	0.11
Hg	2.0	0.010
Se	10	0.21
Ag	50	0.12

Table 3. Summary of ANOVA and LSD determinations for average analyte concentrations (µg/L). Materials with common underlining are not different at the 95% confidence level as determined by the LSD.

	Days	*Well casing*				
		a. Barium				
	1	Control	PTFE	PVC	SS304	SS316
(LSD = 1.4)		4.5	6.0	6.6	7.1	7.7
	5	PTFE	Control	PVC	SS304	SS316
(LSD = 2.1)		5.3	5.8	6.6	7.8	9.9
	20	PTFE	Control	PVC	SS304	SS316
(LSD = 2.2)		5.5	5.9	6.1	7.4	11.3
	40	PTFE	PVC	Control	SS304	SS316
(LSD = 2.0)		5.2	5.6	5.9	7.0	10.1
		b. Chromium				
	1	Control	PTFE	PVC	SS304	SS316
(LSD = 9.76)		0.20	0.22	1.23	1.60	6.06
	5	Control	PTFE	PVC	SS316	SS304
(LSD = 0.31)		0.20	0.22	1.12	1.79	3.34
	20	PTFE	Control	PVC	SS316	SS304
(LSD = 1.17)		0.19	0.22	1.20	3.30	4.61
	40	Control	PTFE	PVC	SS316	SS304
(LSD = 1.04)		0.21	0.21	1.11	2.53	5.13

	Days	*Well casing*				
		c. Lead				
	1	Control	PTFE	SS316	SS304	PVC
(LSD = 1.45)		0.16	0.35	0.90	1.14	2.46
	5	Control	PTFE	SS316	SS304	PVC
(LSD = 1.53)		0.21	0.27	1.27	1.56	2.23
	20	Control	PTFE	SS316	PVC	SS304
(LSD = 2.80)		0.14	0.35	1.00	1.04	2.86
	40	PTFE	Control	PVC	SS316	SS304
(LSD = 1.52)		0.21	0.33	0.78	1.26	2.06
		d. Copper				
	1	PVC	SS304	Control	PTFE	SS316
(LSD = 12.0)		9.4	10.7	11.9	12.1	35.8
	5	PTFE	PVC	Control	SS304	SS316
(LSD = 12.4)		7.8	9.9	10.1	11.0	42.6
	20	PVC	PTFE	Control	SS304	SS316
(LSD = 38.5)		6.8	8.3	10.1	26.1	81.2
	40	PVC	PTFE	SS304	Control	SS316
(LSD = 17.2)		4.4	5.2	11.5	14.0	82.3

The MDL is obtained by multiplying the standard deviation of the replicate measurements by the appropriate one-sided t-statistic corresponding to $n-1$ degrees of freedom at the 99% confidence level.

Each sample aliquot with a determined analyte concentration above the MDL was analyzed at least twice. Analyte concentrations were based on the average peak heights from a strip chart recording.

Aqueous calibration standards for Ag, As, Cd, Cr, Cu, Pb, Hg and Se were prepared by diluting 1000-mg/L certified atomic absorption stock solutions (Fisher Scientific Corp.). A Ba stock standard was made by dissolving a weighed amount of $Ba(NO_3)_2$ (Baker, Reagent Grade) in deionized water. Working standards were prepared in deionized water acidified to 2% v/v with HNO_3 (GFS).

Calibrations were established by determining three different concentration standards in triplicate. Standards were randomly introduced throughout the course of sample analysis, and all of the calibration curves were linear over the concentration range examined. To see if the intercepts were significantly different from zero, we compared the residuals for the models with an intercept and for the models with zero intercept using the F-ratio at the 95% confidence level. Analyte concentrations in the samples and controls were determined based on the slope and intercept only if the intercept was deemed significant. Otherwise, a zero-intercept linear model was employed.

To assess leaching of metals from the surfaces of the four well-casing materials, an analysis of variance (ANOVA) was performed on those metals (Ba, Cr, Cu and Pb) that had been consistently found above the established MDL for the four well-casing materials and the control. If a significant difference was detected by the ANOVA among the average analyte concentrations in the ground water for a given material, then a Least-Significant-Difference (LSD) analysis was performed. Both analyses (ANOVA and LSD) used the 95% confidence level. The results of these analyses established which well casings contributed particular analytes to the ground water over and above those contributed by other well casings or the control for the different exposure periods (Table 3). In addition the aqueous metal concentrations that exceed 1% of the EPA drinking water quality level were identified. This low-level warning criterion was chosen since this study did not always establish the native levels present in the ground water. Thus, the contribution of metals from the well casings could range from one or more orders of magnitude above the background concentrations.

RESULTS

Barium

The analysis of the 1-day exposure samples showed that all of the ground-water-filled vessels containing pipe sections had aqueous Ba concentrations that were significantly greater than that of the control; however, all of the values were low (Table 3a). The subsequent exposure periods do not follow this pattern but instead established that SS 316 was the only material that consistently contributed significant levels of Ba to the solution relative to the other samples and the controls (Fig. 1a). The average increase in aqueous concentration for the ground water exposed to SS 316 was about 70% compared to the control. After 5 days of exposure, ground water in contact with SS 316 developed aqueous Ba concentrations that exceeded 1% of the drinking water quality level established by the EPA. None of the other well casings tested produced aqueous Ba concentrations that exceeded 1% of the EPA drinking water quality criterion or were significantly different from the control after the initial exposure period.

Cadmium

We did not use ANOVA with Cd since the majority of concentrations determined were below the MDL (Appendix A). After 1 day of exposure, both ground-water solutions containing SS 316 and PVC had aqueous Cd that exceeded 1% of the EPA drinking water quality level.

Figure 1b shows the average Cd concentrations determined for the control and well casings. It appears that Cd is initially released from SS 316 and PVC but becomes resorbed onto the well casing with time. Stainless steel 316 contributes approximately an order of magnitude (more than 10% of the EPA drinking water quality level in some cases) more Cd than PVC for equivalent exposure periods.

Chromium

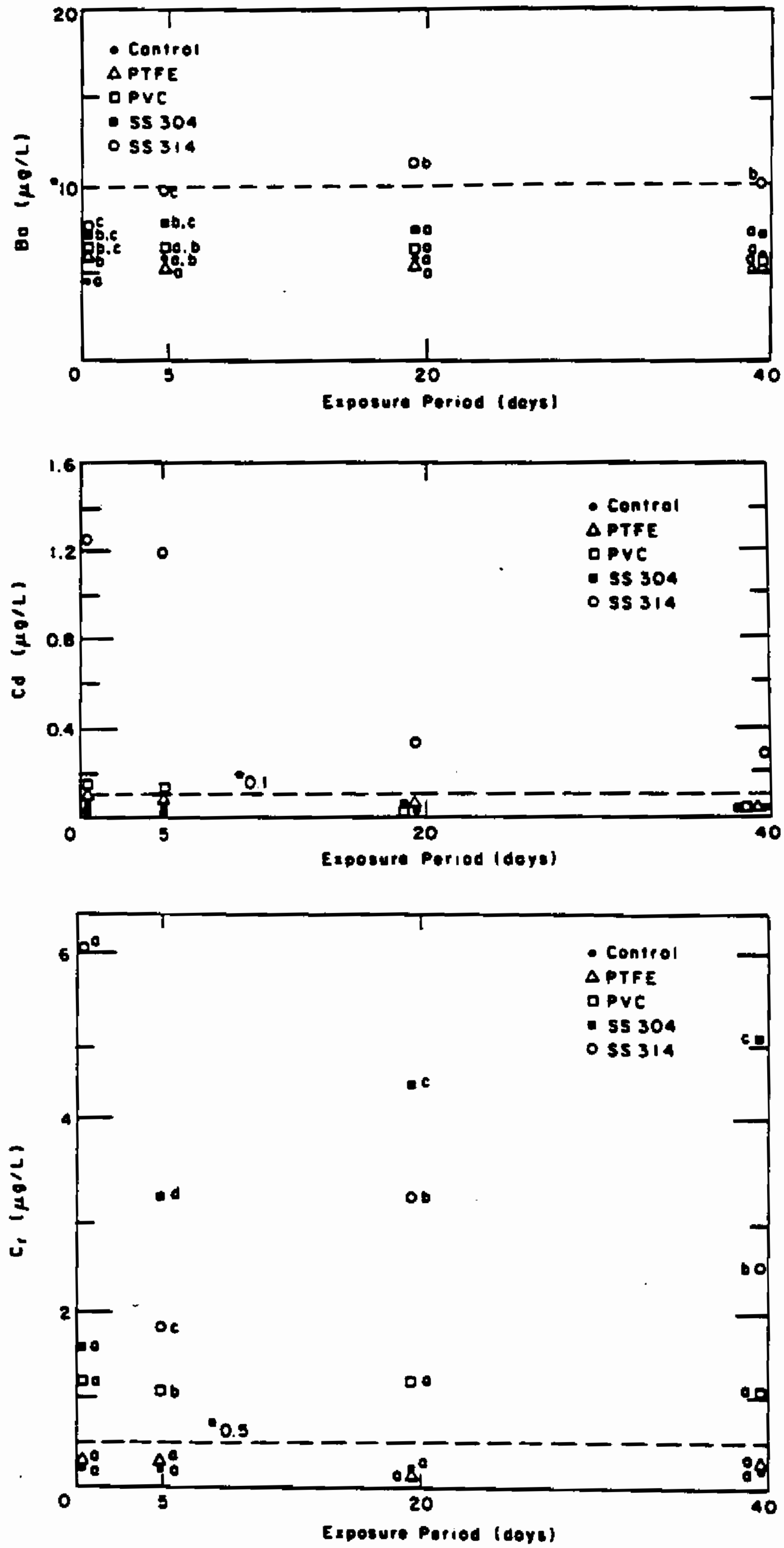
Beyond the 1-day exposure, the analysis consistently demonstrated that both stainless steel well casings contributed significantly greater quantities of Cr to the ground water than the control or the other materials tested (Table 3b). These metal well casings, along with PVC, increased Cr concentrations in the ground water above 1% of the EPA drinking water quality level (Fig. 1c). The extent of the Cr contamination coming from the PVC was three to five times less than that coming from the SS 304, which usually showed the highest average contamination for a given exposure period, the exception being the initial exposure period.

The ANOVA and LSD tests failed to distinguish any difference between the materials for the 1-day exposure because of the large variation among the the three SS 316 samples. If SS 316 is removed, the analysis shows both PVC and SS 304 to contribute significantly greater quantities of Cr to the ground water than do the control and PTFE. The only material that showed a consistent trend was SS 304 (Fig. 1c), which created increasing concentrations of Cr with time. Throughout the experiment there was no significant difference for Cr between the control and the PTFE well casing.

Lead

The first two exposure periods showed PVC to leach the greatest amount of Pb and to be significantly different from the control and PTFE. The two longest exposure periods showed that SS 304 leached the greatest amount of Pb to ground water; however, the levels observed in solution for SS 304 were only statistically different from the rest for the 40-day exposure period (Table 3c). The average levels obtained for both of the stainless steels and for PVC consistently exceeded 1% of the EPA drinking water quality standard (Fig. 1d).

The most distinctive trend was the decrease in Pb with increasing time of exposure for PVC (Fig. 1d). Both stainless steel well casings showed slight decreases in Pb levels after aqueous concentration maxima were obtained. The Pb that was initially released was resorbed by the PVC and stainless steel well casings. Throughout the experiment, there was no significant difference among the control, SS 316 and PTFE.

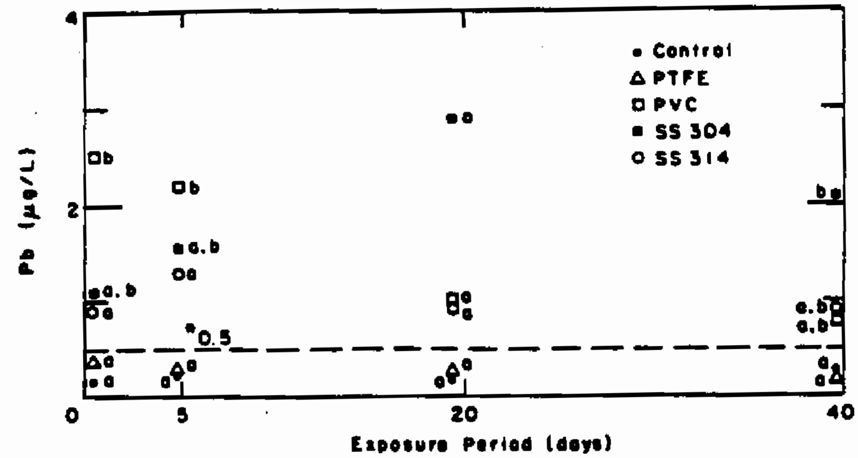


a. Ba.

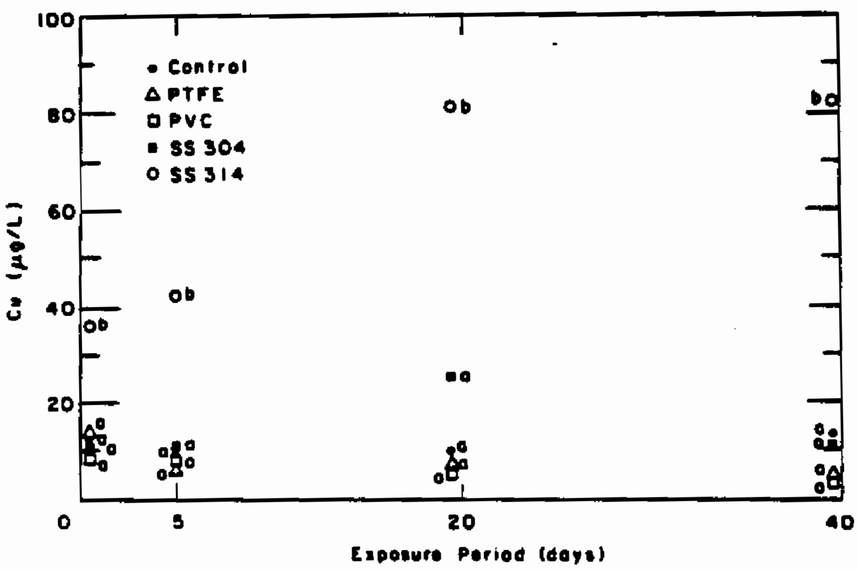
b. Cd.

c. Cr.

Figure 1. Ground-water leaching of metals from well casings being examined. Common letters next to points denote no significant difference at the 0.05% confidence interval as determined by ANOVA and LSD.



d. Pb.



e. Cu.

Figure 1 (cont'd).

Copper

The statistical analysis distinguished SS 316 as the only material that contributed significantly more Cu when exposed to ground water than the other materials tested (Table 3d). Aqueous concentrations exceeded 80 µg/L for SS 316 versus about 10 µg/L for the other materials and the control.

Both PTFE and PVC well casing showed a general trend of decreasing Cu with increasing time of exposure and often showed concentrations below the control (Fig 1e). This trend, along with the lack of any trend with respect to the control, demonstrates that these two plastic pipes provided the substrate for sorption.

Arsenic, mercury, selenium and silver

The determinations for As, Hg, Se and Ag were not statistically analyzed because the majority of the concentrations were at or below the established MDLs. Based on the analysis methods employed, none of the well casings consistently contributed As, Hg or Ag above 1% or Se above 2% of the EPA drinking water quality level.

DISCUSSION

Ground water was collected from a domestic well system and stored in sealed 2-L glass bottles for approximately 24 hours prior to being transferred into test jars. Ground water collected in this fashion is aerated at the faucet and exposed to an oxygen-rich environment every time the lid of the container is removed. Handling the ground water in this manner most likely changed the oxidation potential, facilitating oxidation reactions (Stumm and Morgan 1970). We made no attempt to simulate the natural ground-water redox state or to quantitatively assess the chemical equilibria that existed during the course of this experiment.

There was visible rust on 11 of 24 sections of the stainless steel pipes (Table 4). Each pipe section was carefully examined prior to submersion and after removal from the ground water. In this experiment and in a previous one (Hewitt 1989), oxidation on the stainless steel was predominantly found on the wall. If oxidation is providing sites for sorption or release mechanisms, then the freshly cut surfaces were most likely not a major factor in the behavior of these two materials. Fresh surfaces on the PVC pipe is not an experimental artifact since PVC well screen is made by slotting the pipe.

It was apparent from the values determined for the control samples that the three 2-L glass bottles used to transport the ground water had different concentrations of aqueous Cu (Appendix A). The range of aqueous Cu concentrations most likely reflect the residence time of the ground water in the household and well plumbing. Three distinct populations of Cu concentration were determined for the controls at the 99% confidence level (X_1 = 9.8±0.0, n = 4; X_2 = 10.3±0.22, n = 5; X_3 = 16.0±0.0, n = 3). Differences between adjacent mean concentrations were established by testing against the maximum variance determined for all of populations (i.e., X_1X_2 and X_2X_3).

The groups established by the three Cu populations were then tested to determine if any of the other metals found above its MDL were also significantly different. Table 5 presents the averages and standard deviations for the metal groups based on the Cu populations for the controls. Only Pb shows the same increasing mean concentration trend as the Cu groupings; however, the averages for the adjacent Pb groups were not significantly different at the 95% or even the 80% confidence level when analyzed in the same manner as the Cu populations. This analysis establishes that only Cu was significantly influenced by the sample preparation procedure. Mixing the ground water from the three collection bottles would have eliminated

Table 4. Physical state of stainless steel pipes after exposure to ground water.

	Section 1	2	3	4	5	6	7	8	9	10	11	12
SS 304	WR	WR	—	—	WR	—	WR	WR	ER	WR	WR	WR
SS 316	—	—	—	—	ER	—	—	—	—	—	—	ER

KEY: WR = rust on wall; ER = rust on edge; dash means no rust.

Table 5. Average metal concentrations for the controls based on the groups established by the Cu populations (µg/L).

Populations		*Cu*	*Cr*	*Pb*	*As*	*Ba*
1	Avg.	9.8*	0.22	0.11	0.55	5.2
	Std. Dev.	0.0	0.021	0.00	0.114	0.92
2	Avg.	10.3*	0.20	0.25	0.48	5.8
	Std. Dev.	0.19	0.032	0.154	0.00	0.29
3	Avg.	16.0*	0.22	0.28	0.48	5.6
	Std. Dev.	0.0	0.021	0.048	0.00	0.75

* Statistically different at the 99% confidence level.

Table 6. Summary of results.

	Ba	*Cd*	*Cr*	*Pb*	*Cu*
Materials that leached >1% of the EPA drinking water quality level in ground-water solutions.	SS 316 PVC	SS 316 PVC	SS 304 SS 316 PVC	SS 304 PVC SS 316	NA*
Material that showed the highest average overall amount of analyte leached	SS 316	SS 316	SS 304	SS 304	SS 316

* Does not apply.

this artifact. The level of Cu leached from the SS 316 far exceeded the difference between the established populations.

The results of this study support our previous work (Hewitt 1989) showing that PTFE is the least reactive material, whereas both PVC and stainless steel well casings influence aqueous concentrations of metals in laboratory ground-water solutions. As in the first study, the variance among the stainless steel replicates was often the greatest, indicating that this material is susceptible to producing random error. Both studies found that SS 316 and PVC leach and sorb Cd; in addition, these two materials, along with SS 304, sorb Pb. Studies in the future should be conducted under anoxic conditions to see if oxidation of the stainless steel is simply an artifact of these experiments. If corrosion of stainless steel is absent under reducing conditions, then we might expect less random variation and less of an influence on the metal analytes in ground-water solutions.

A summary of the results (Table 6) clearly shows that the stainless steels were the greatest sources of contamination under these experimental conditions. When PVC leached metals (Pb, Cr and Cd) that exceeded 1% of the EPA drinking water quality specifications into solution, there was always a trend showing a decrease in concentration with time of exposure. This would suggest that the leaching of Pb, Cr and Cd from PVC is a surface process and is small. Most likely the initial release could be decreased by more extensive cleaning before the pipes are used. The same statement does not apply to the stainless steel well casings. In the cases of leached Cu from SS 316 and leached Cr from SS 304, the concentrations of these metals continually increased with time over 40 days. It is possible that stainless steels could supply these analytes to ground water over an extended period of time, perhaps the entire life of the casing.

CONCLUSION

Among the four types of well casings tested, PTFE was the only material that did not leach any of the nine metals examined. The other materials tested in this experiment (PVC, SS 304 and SS 316) compromised laboratory ground-water samples by contributing analytes of interest (Ba, Cd, Cr, Pb and Cu). Investigations where only trace metals are of interest should use PTFE below the saturated zone. PVC would be the appropriate second choice since its influence on metal analytes appears predictable and small. In contrast, the two stainless steel materials should be avoided.

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APPENDIX A: LEVELS OF CD, PB, CR, BA AND CU DETERMINED IN GROUND-WATER SOLUTIONS (~~MG~~/L).

ug

Pipe	Replicate	Time (days)	Number	Cd	Pb	Cr	Ba	Cu
Cntrl	1	1	1	<D*	0.11	0.21	4.2	9.8
Cntrl	2	1	2	<D	0.11	0.19	4.6	9.8
Cntrl	3	1	3	<D	0.26	0.21	4.8	16.0
Cntrl	1	5	4	<D	0.40	0.15	5.5	10.5
Cntrl	2	5	5	<D	0.11	0.24	5.8	9.8
Cntrl	3	5	6	<D	0.11	0.20	6.1	10.1
Cntrl	1	20	7	<D	0.11	0.24	6.1	10.1
Cntrl	2	20	8	<D	0.11	0.22	6.1	9.8
Cntrl	3	20	9	<D	0.19	0.20	5.5	10.5
Cntrl	1	40	10	<D	0.42	0.20	5.8	10.1
Cntrl	2	40	11	<D	0.24	0.20	5.7	16.0
Cntrl	3	40	12	<D	0.33	0.24	6.3	16.0
PTFE	1	1	1	<D	0.40	0.19	5.9	10.8
PTFE	2	1	2	<D	0.26	0.28	6.1	9.8
PTFE	3	1	3	<D	0.40	0.19	5.9	15.7
PTFE	1	5	4	0.117	0.40	0.24	4.9	9.1
PTFE	2	5	5	<D	0.30	0.21	5.5	8.4
PTFE	3	5	6	<D	0.11	0.21	5.5	5.9
PTFE	1	20	7	0.117	0.40	0.21	5.8	15.3
PTFE	2	20	8	<D	0.30	0.16	5.2	4.9
PTFE	3	20	9	<D	0.36	0.19	5.5	4.6
PTFE	1	40	10	<D	0.11	0.21	4.9	4.3
PTFE	2	40	11	<D	0.11	0.16	5.5	7.0
PTFE	3	40	12	<D	0.40	0.26	5.2	4.3
PVC	1	1	1	0.109	2.19	1.13	6.7	9.4
PVC	2	1	2	0.125	3.09	1.40	7.0	9.8
PVC	3	1	3	0.175	2.11	1.15	6.1	9.1
PVC	1	5	4	0.075	2.39	1.15	7.3	8.0
PVC	2	5	5	0.142	2.43	1.30	6.4	13.2
PVC	3	5	6	0.109	1.87	0.91	6.1	8.4
PVC	1	20	7	<D	2.11	1.30	6.4	11.9
PVC	2	20	8	<D	0.66	1.40	5.8	4.3
PVC	3	20	9	<D	0.34	0.91	6.1	4.3
PVC	1	40	10	<D	0.93	1.08	6.1	4.3
PVC	2	40	11	<D	0.75	1.03	5.2	4.3
PVC	3	40	12	<D	0.66	1.22	5.5	4.6
SS 304	1	1	1	<D	0.48	1.22	6.7	9.8
SS 304	2	1	2	<D	0.88	1.13	7.0	13.2
SS 304	3	1	3	<D	2.05	2.45	7.6	9.1
SS 304	1	5	4	<D	1.25	3.33	7.3	9.8
SS 304	2	5	5	<D	0.96	3.21	8.2	8.0
SS 304	3	5	6	<D	2.47	3.48	7.9	15.3
SS 304	1	20	7	0.092	0.80	4.36	7.3	9.1
SS 304	2	20	8	<D	2.81	3.87	7.6	49.7
SS 304	3	20	9	<D	4.98	5.59	7.3	19.6
SS 304	1	40	10	<D	2.97	5.10	6.7	9.1
SS 304	2	40	11	<D	1.47	4.56	6.4	9.4
SS 304	3	40	12	<D	1.73	5.73	7.9	15.9
SS 316	1	1	1	2.629	0.41	1.48	7.0	27.5
SS 316	2	1	2	0.209	0.60	1.29	7.3	35.5
SS 316	3	1	3	0.926	1.70	15.36	8.7	44.5
SS 316	1	5	4	0.217	0.96	1.81	8.5	37.2
SS 316	2	5	5	2.930	2.30	1.69	11.5	37.6
SS 316	3	5	6	0.451	0.55	1.86	9.6	52.9
SS 316	1	20	7	0.326	1.50	3.45	12.3	102.2
SS 316	2	20	8	0.376	0.76	2.96	9.3	56.7
SS 316	3	20	9	0.326	0.75	3.50	12.3	84.8
SS 316	1	40	10	0.267	0.67	3.18	11.5	97.3
SS 316	2	40	11	0.384	0.75	1.94	9.0	77.2
SS 316	3	40	12	0.209	2.36	2.45	9.8	72.3

* Less than MDL.

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Influence of Casing Materials on Trace-Level Chemicals in Well Water

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Abstract

Four well casing materials — polyvinyl chloride (PVC), polytetrafluoroethylene (PTFE), and stainless steel 304 (SS 304) and 316 (SS 316) — were examined to determine their suitability for monitoring inorganic and organic constituents in well water.

The inorganic study used a factorial design to test the effect of concentration of mixed metals (arsenic [As], chromium [Cr], lead [Pb], and cadmium [Cd]), pH, and organic carbon. Sample times were 0.5, 4, 8, 24, and 72 hours. Except for slow loss of Pb, PTFE well casings had no significant effect on the concentration of metals in solution. For the other casings, changes in analyte concentration often exceeded 10 percent in eight hours or less and, thus, could bias analyses of samples taken from wells constructed with these materials. Specifically, PVC casings sorbed Pb and leached Cd; SS 316 casings sorbed As and Pb and leached Cd; and SS 304 casings sorbed As, Cr, and Pb and leached Cd. Both stainless steel casing materials showed markedly poorer performance than the PVC casings.

The well casings were also tested for sorption/desorption of 10 organic substances from the following classes: chlorinated alkenes, chlorinated aromatics, nitroaromatics and nitramines. Sample times were 0, 1, 8, 24, and 72 hours, seven days, and six weeks. There were no detectable losses of analytes in any of the sample solutions containing stainless steel well casings. Significant loss of some analytes was observed in sample solutions containing plastic casings, although losses were always more rapid with the PTFE casings than with PVC. Chlorinated organic substances were lost most rapidly. For samples containing PTFE casings, losses of some of these compounds were rapid enough (>10 percent in eight hours) to be of concern for ground water monitoring. Losses of hydrophobic organic constituents in samples containing PTFE casings were correlated with the compound's octanol/water partition coefficient.

Introduction

The U.S. Environmental Protection Agency's (EPA's) RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD) (U.S. EPA 1986a) states that only fluorocarbon resins or stainless steel (SS) casings should be used for monitoring volatile organics in the saturated zone. The original draft of this document (U.S. EPA 1985) suggested that Teflon® or stainless steel 304 be used for all ground water monitoring at RCRA sites. The EPA was concerned that many of the casing materials used for ground water monitoring could either affect the quality of the ground water or did not have the long-term structural characteristics required of RCRA monitoring wells. With respect to the EPA's first concern, a review of the literature published prior to 1986 did not reveal substantial evidence to support the position taken by the EPA in either edition of this document (Parker et al. 1989).

Few studies have specifically addressed the possible interactions between well casing materials and metal species. There is considerable evidence, however, that sorption of metals by plastic and glass containers can be significant (Eicholz et al. 1965, Robertson 1968, Batley and Gardner 1977, and Masse et al. 1981). In one study of PVC well casings, there was negligible loss of chromium but large losses of lead from a deionized water solution (Miller 1982). Other studies with Pyrex glass and polyethylene also found that lead was the most rapidly lost analyte (Shendrikar et al. 1976). Barcelona and Helfrich (1986) compared the concentrations of several metal species in samples taken from adjacent PVC, PTFE, and SS wells. They found increased levels of iron in water samples from the non-purged SS well to be the only statistically significant difference. In a previous in situ study by Houghton and Berger (1984), a steel-cased well appeared to leach a number of metal species, including iron, cadmium, chromium, copper, manganese, molybdenum, selenium, and zinc, when compared with a PVC well and one constructed of acrylonitrile-butadiene-styrene (ABS).

Sorption of organic solutes by well casing materials has been reported in several publications. Miller (1982) tested PVC well casing for sorption of trace levels (2-14 ppb) of six halogenated organic compounds (bromoform, trichlorofluoromethane, trichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, and tetrachloroethylene) in aqueous solution and found slow losses of tetrachloroethylene (25-50 percent in six weeks).

Reynolds and Gillham (1986) tested both PVC and PTFE materials for sorption of trace levels (ppb) of five halogenated organics. They found rapid sorption of tetrachloroethylene by PTFE, slow sorption of 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane and hexachloroethane, and no sorption of bromoform. They also found slow sorption of all the analytes except trichloroethane by PVC. While 50 percent of the tetrachloroethylene was sorbed by the PVC in five weeks, the same amount was sorbed by PTFE in only eight hours. They attributed loss of these organics to absorption and developed a model where uptake of the compound proceeds by sorption/dissolution into the polymer surface, followed by diffusion into the polymer matrix. However, Reynolds and Gilham (1986) could not predict which organic chemicals were most susceptible to absorption.

Sykes et al. (1986) compared sorption of several organics by PVC, SS, and PTFE well casings. The casing materials were equilibrated for seven days (5 C) in analyte solution, placed in fresh analyte solution, and then tested for losses due to sorption after one and 24 hours. After 24 hours they did not find any significant losses for any of the casing materials.

While these studies indicate that sorption of some organics may be a significant problem for plastic casings over the long term, only the study by Miller (1982) examined desorption during the first two weeks. In that study, he observed some desorption (25 percent) of the tetrachloroethylene that had been previously sorbed by the PVC casings.

Casing materials may also leach a variety of organic substances. In two studies (Miller 1982, Parker and Jenkins 1986), analytical interferences in leachates from PVC well casings were sought but none were found. Curran and Tomson (1983) also examined the leachates from five plastics, including PVC and PTFE. They found that PTFE leached the fewest contaminants and that non-glued PVC was a close second. While it is possible that organic substances such as lubricants used during manufacture or inks from printing could leach from stainless or plastic casings, no information currently available in the literature confirms this.

It is interesting to note that despite the literature that is available regarding sorption of organics by PTFE, articles have recently been published that claim it is superior for sampling organic substances (e.g., Bryden and Smith 1989).

The purpose of the studies conducted by the authors was to determine the suitability of four well casing materials (PVC, PTFE, SS304, and SS316) for monitoring inorganic and organic solutes in ground water. To do this, two separate studies were conducted, one for inorganics and one for organics.

General Comments on the Inorganic and Organic Studies

Two-inch (inner) diameter well casings manufactured specifically for ground water monitoring were used in all studies. These casings were purchased specifically for the studies and were stored in a cool, dry room prior to use. Precautions were taken while the casings were being cut to prevent contamination from grease, dirt, oil, solvents, and excessive handling. The ground water used in the studies was obtained from a domestic well (249 feet [76m] deep) in Weathersfield, Vermont. No attempt was made to maintain the native dissolved oxygen level. As a general guideline for evaluating our results, we considered any change in concentration (relative to the control samples) of 10 percent in an eight-hour period to be the maximum change tolerable.

Inorganic Study

Experimental

Mixed metal solutions were prepared by spiking ground water with arsenic (As), cadmium (Cd), chromium (Cr) and lead (Pb) at two concentrations: 50 and 100 µg/L (ppb) for As, Cr, and Pb, and 10 and 2 µg/L for Cd. The higher concentrations are the current maximum concentration limits set by the EPA for drinking water (U.S. EPA 1986b). Prior to treatment, the ground water used in this study was analyzed and found to contain no detectable amounts of any of these metals at the sensitivity levels used for analysis. To simulate a wider range of ground water conditions, the tests were run at the natural pH (7.8) of the well water plus a lower pH (5.8) and at two levels of organic carbon. HCl (reagent grade) was added to lower the pH and 5 mg/L (ppm) of humic acid was added to raise the organic carbon content. A complete (2^3) factorial experiment was used to test the effect of these treatments (concentration of metals, pH and organic carbon content) (Table 1).

Because the wall thicknesses varied between the plastic and the two stainless steel casings, the casings

TABLE 1
Matrix Design for Inorganic Study

Test Condition	Metal Concentrations[1]	pH	Organic Carbon Added[2]
1	high	7.8	no
2	high	7.8	yes
3	high	5.8	no
4	high	5.8	yes
5	low	7.8	no
6	low	7.8	yes
7	low	5.8	no
8	low	5.8	yes

[1] High metal concentrations were 50 µg/L As, Cr, Pb, and 10 µg/L Cd. Low metal concentrations were 10 µg/L As, Cr, Pb, and 2 µg/L Cd.
[2] 5 mg/L humic acid was added as a source of organic carbon.

were cut to different lengths so that the surface area of each was constant (80 cm^2). Cut sections were rinsed with deionized water and air-dried before use. Individual well casings were then placed in 125mL polypropylene jars containing 100mL of test solution; the ratio of casing surface area to aqueous volume was 0.82 cm^2/mL. Similar jars that contained the test solutions without any casings were used for control samples. The sample vessels were covered, stored at 24 C and kept from natural light. Duplicates were run for each combination of variables and each casing material.

Sample aliquots (2.5mL) were taken from each container after 0.5, 4, 8, 24, and 72 hours. The aliquots were placed in clean 7.5mL polyethylene vials and acidified to a pH of less than 1 with nitric acid to prevent sorption by the containers. Metal concentrations were obtained by graphite furnace atomic absorption spectroscopy (Perkin-Elmer, model 703 atomic absorption spectrophotometer coupled with a PE model 2200 heated graphite atomizer). The concentrations of metals given in this study were measured as total.

The metal concentrations were normalized by dividing the values obtained for sample solutions that contained well casings by the values found for equivalent controls. This allowed the results for both concentrations to be analyzed by a single analysis of variance (ANOVA). Thus, it was possible to simultaneously test for the effect of solute concentration, pH and organic carbon at each sample time for each casing material. If a casing exerted no influence on analyte concentration, the expected value would be 1.00. An increase in the ratio indicates that the well casing released metal into the solution, while a decrease in the ratio indicates that metal was sorbed by the casing.

Results and Discussions

Approximately half of the stainless steel casings showed signs of surface rust. In some cases (SS 316 at a low pH), sufficient oxidation occurred to form a hydrous iron oxide precipitate. This precipitate was never observed in the control samples or those with PVC or PTFE casings. While the authors realize that rusting of the stainless casings is very condition-specific, the test conditions should be generally representative of shallow wells. Also, it was noticed that the casings had rusted some during storage prior to any testing.

Table 2 gives the normalized mean values and standard deviations for each analyte, well casing and time.

TABLE 2
Normalized Mean Metal Values[1] for Samples as a Function of Time

		Arsenic		Cadmium		Chromium		Lead	
Time (hr)	Pipe	Mean Value	Standard Deviation	Mean Value	Standard Deviation	Mean Value	Standard Deviation	Mean Value	Standard Deviation
0.5	PVC	0.991 ±	0.038	1.01 ±	0.025	1.01 ±	0.018	0.999 ±	0.009
	PTFE	0.999 ±	0.050	1.01 ±	0.011	1.01 ±	0.007	1.00 ±	0.026
	SS304	0.997 ±	0.057	1.06 ±	0.036	1.01 ±	0.016	1.02 ±	0.008
	SS316	0.994 ±	0.040	1.04 ±	0.021	1.02 ±	0.015	1.01 ±	0.025
4.0	PVC	1.02 ±	0.045	1.13 ±	0.037	0.999 ±	0.013	0.889 ±	0.030
	PTFE	0.993 ±	0.052	1.03 ±	0.054	1.01 ±	0.011	0.974 ±	0.019
	SS304	0.978 ±	0.063	1.17 ±	0.15	0.957 ±	0.037	0.784 ±	0.035
	SS316	0.945 ±	0.060	1.24 ±	0.49	0.921 ±	0.052	0.803 ±	0.077
8.0	PVC	1.00 ±	0.045	1.15 ±	0.037	1.00 ±	0.014	0.893 ±	0.035
	PTFE	1.01 ±	0.098	1.03 ±	0.016	0.989 ±	0.019	0.985 ±	0.032
	SS304	0.962 ±	0.057	1.16 ±	0.14	0.972 ±	0.16	0.699 ±	0.031
	SS316	0.945 ±	0.068	1.30 ±	0.47	0.872 ±	0.10	0.804 ±	0.10
24.0	PVC	0.994 ±	0.064	1.16 ±	0.056	1.00 ±	0.016	0.808 ±	0.051
	PTFE	0.992 ±	0.054	1.03 ±	0.017	1.01 ±	0.024	0.951 ±	0.040
	SS304	0.894 ±	0.051	1.12 ±	0.12	1.03 ±	0.37	0.538 ±	0.042
	SS316	0.853 ±	0.080	1.36 ±	0.68	0.855 ±	0.11	0.793 ±	0.19
72.0	PVC	1.03 ±	0.046	1.14 ±	0.049	1.01 ±	0.018	0.743 ±	0.064
	PTFE	1.02 ±	0.045	1.02 ±	0.022	1.00 ±	0.013	0.899 ±	0.034
	SS304	0.891 ±	0.084	1.03 ±	0.14	1.03 ±	0.42	0.452 ±	0.061
	SS316	0.874 ±	0.083	1.25 ±	0.66	0.836 ±	0.099	0.720 ±	0.17

[1] $\frac{\text{(Concentration for samples with casing)}}{\text{(Concentration for control samples)}}$ = Normalized mean value

These normalized values are the mean of all the treatments (i.e., for both pHs, organic carbon content, and concentration).

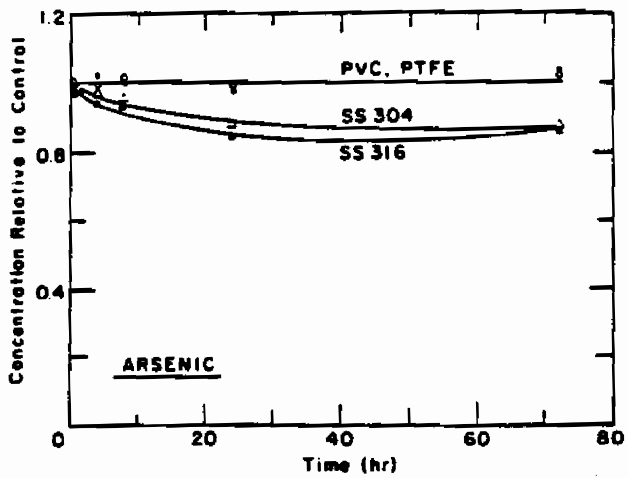

Figure 1. Trends in mean arsenic concentration for four well casing materials.

In general, there was no change in arsenic concentration for the sample solutions containing either the PVC or PTFE casings during the 72-hour test period (Figure 1), and no consistent pattern of effects was evident from the ANOVA. The reason As did not interact with these casings may be because As exists in natural waters in the anionic form (Fowler et al. 1979). Masse et al. (1981) found that anions do not strongly associate with plastic (polyethylene and PTFE) surfaces, which are known for their cation exchange capacity. The samples containing the stainless steel casings, on the other hand, showed a 10 percent decrease in aqueous arsenic concentration relative to the controls after 24 hours (Figure 1). It appears that there was no further loss of this analyte after 24 hours. Although these results cannot be used to predict exactly what losses might occur under field conditions, it is doubtful that this loss was rapid enough to impact water quality measurements (losses were less than 10 percent after eight hours).

The results for Cd are quite different. After only four hours, Cd concentrations in the samples containing PVC and stainless steel casings had increased by more than 10 percent (Figure 2), with the most leaching occurring in the samples containing the SS 316 casings. Cadmium may have been added to the PVC as a UV stabilizer (Wilson et al. 1982), and may have been added to the stainless steel to enhance resistance to chloride cracking (Sedricks 1979). The concentration of Cd in the samples containing PVC casings leveled off after eight hours. ANOVA revealed that pH had a significant effect (at the 95 percent confidence level) for this casing. Although the same amount of Cd leached in all the samples (approximately 0.5 mg/L), concentration was also significant (at the 95 percent confidence level), but only because relatively more was leached in the low-concentration samples. Concentrations in samples containing SS 304 casings decreased after eight hours and after 72 hours had returned to the same levels that were found in the control samples. Again, more Cd leached in the low pH samples. Cd was leached most rapidly in samples containing SS 316 casings. There was a large discrepancy between duplicate treatments for the samples that contained stainless steel casings. With the exception of the first set of samples (t = 0.5 hr), the relative standard deviations ranged from 12 to 15 percent for samples containing SS 304 and from 47 to 68 percent for those containing SS 316. In contrast, the standard deviations for samples containing PVC and PTFE casings were consistently below 6 percent. Because the variance in the samples containing SS 316 was so large, there was no consistent detectable effect of pH for these casings. However, surface oxidation appeared to be the major source of this variance. With respect to the leaching of metal stabilizers from PVC pipes, the literature indicates that loss can be a surface phenomenon that can be reduced or eliminated by either washing (with detergent) or soaking in dilute mineral acid before use (Packham 1971). It may be that the loss of Cd from PVC casings can also be reduced by a similar treatment, although we did not test this possibility.

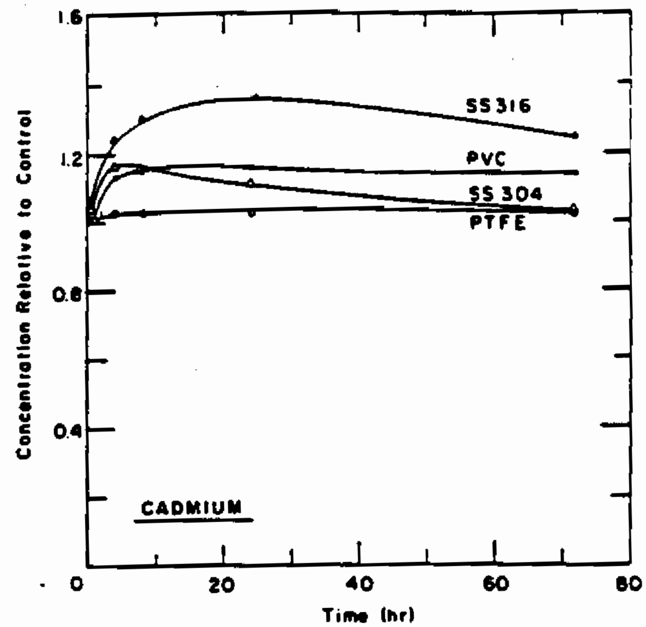

Figure 2. Trends in mean cadmium concentration for four well casing materials.

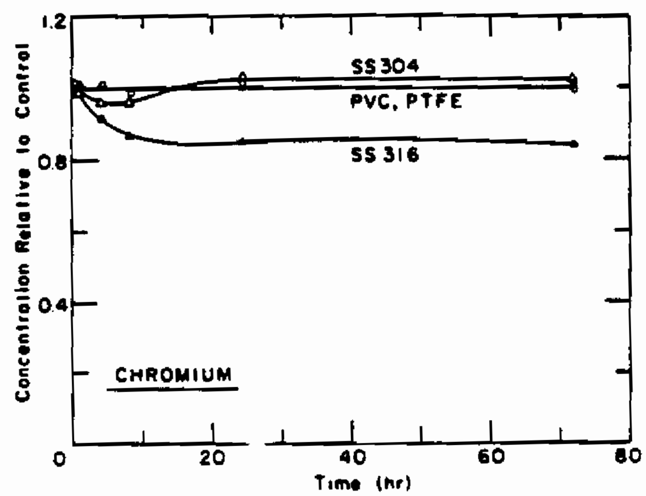

Figure 3. Trends in mean chromium concentration for four well casing materials.

There was no measurable sorption of chromium by the PTFE, PVC, and SS 304 casings (Figure 3). Absence of interaction with the plastic casings may be due to chromium speciation. In solution, chromium exists predominantly as dichromate and chromate ($Cr_2O_7^{2-}$, CrO_4^{2-}) and, as mentioned previously, anions are not as likely to exchange with plastic surfaces. However, loss of chromium was rapid enough (13 percent after eight hours) for SS 316 casing material to be of concern for ground water monitoring. Losses were greater at the higher pH: Cr speciation is known to be affected by pH and may be responsible for some of these differences. Surface oxidation was greater at the lower pH, which likely contributed to the larger variability. Also, for those samples where a hydrous iron oxide precipitate was formed, co-precipitation may have contributed to the losses from solution. Again, the standard deviations were considerably greater for the samples containing the stainless steel casings. Humic acids apparently increased the stability of aqueous Cr, perhaps by acting as a complexing agent (Stumm and Morgan 1970s).

Lead was by far the most actively sorbed metal species. While all sample solutions containing casing materials showed some loss of Pb with time (Figure 4), PTFE was the least active surface and SS 304 was the most active. The losses for samples containing PTFE casings do not appear to be of concern with respect to ground water monitoring; losses were only 5 percent after 24 hours. However, losses for samples containing PVC and stainless casings are of concern: losses were 10 percent after only four hours in the samples containing PVC casings and 20 percent in those containing stainless casings. Although loss was initially rapid in samples containing SS 316 casings, it leveled off after eight hours. The standard deviation was higher for the samples containing SS 316 casings than for the other casings. For both stainless steel casings, there was less sorption of Pb at the lower pH where hydrogen ions may have competed for sorption sites. Added humic material apparently acted as a complexing agent in solution, making lead less prone to sorption. Concentration had no consistent effect.

Undoubtedly, there were shifts in the chemical equilibria of the well water solutions from the time the well water was collected until the end of the experiment. Ground water that is removed from an anoxic environment and exposed to oxygen-rich air may undergo redox and precipitation reactions (Stumm and Morgan 1970b). Also, lowering the pH shifts the carbonate equilibrium in solution from predominantly bicarbonate species toward carbon dioxide (Manahan 1972) and causes shifts in Cr speciation. Clearly, such changes would alter the trace metal species distribution. These possible changes were not monitored in this experiment.

For further details on this portion of the study, refer to Hewitt (1989).

Organic Study

Experimental

The four well casing materials were also tested for sorption/desorption of low levels of 10 organic substances. The substances tested were hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), 1,3,5-trinitrobenzene (TNB), cis- and trans-1,2-dichloroethylene (CDCE and TDCE), m-nitrotoluene (MNT), trichloroethylene (TCE), chlorobenzene (CLB), and o-, p- and m-dichlorobenzene (ODCB, PDCB, MDCB). The criteria used for selecting these analytes included being an EPA priority pollutant, molecular structure, solubility in water, K_{ow} value, and retention time (using reversed-phase high performance liquid chromatography [HPLC] analysis). HPLC analysis of the ground water used in these studies revealed no detectable levels of any of these substances.

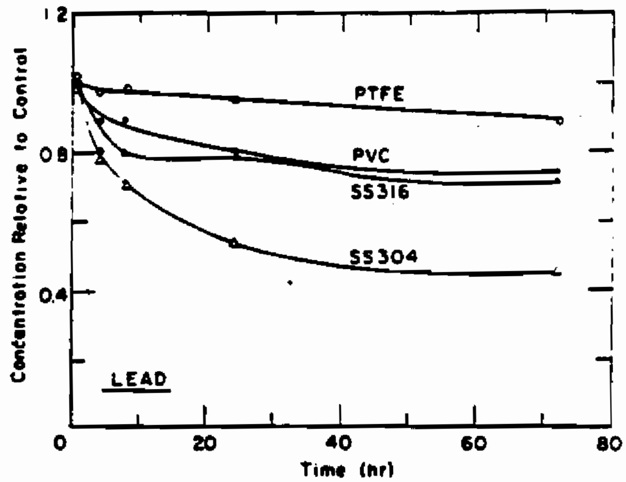

Figure 4. Trends in mean lead concentration for four well casing materials.

For these experiments, casings were cut into 11- to 14mm-long sections, which were then cut into quarters. Again, the length was varied so that the surface area could be maintained constant. The casings were washed in solutions of detergent and deionized water, rinsed many times with deionized water, drained and left to air dry. Two pieces of each type of casing were placed in 40mL glass vials that were filled with the aqueous test solution so there was no head space, and capped with Teflon-lined plastic caps. Vials with test solution but no well casing material served as controls. These controls allowed us to eliminate any effects such as those that might be due to the vials or caps. The ratio of casing surface area to solution volume was 0.79 cm^2/mL. The ratio of solution volume to volume of casing material was approximately 10:1.

In the first experiment, the test solution was prepared by adding known amounts of each of the organic solutes directly to 2.2 L of well water in a glass-stoppered bottle, which was stirred overnight. The final concentration was approximately 2 mg/L for each organic constituent. The solution also contained 40 mg/L of $HgCl_2$, which was added to prevent biodegradation of the organics. Separate vials were prepared for each sample time so that the test solution could be discarded after sampling; there were three replicate samples for each material and time. Contact times were 0 hours, one hour, eight hours, 24 hours, 72 hours (three days), 168 hours (seven days), and approximately 1000 hours (six weeks).

After an aliquot was removed for analysis from each

TABLE 3

Normalized[1] Average Concentrations of Organic Analytes for the Four Well Casings with Time

Analyte	Treatment	1 Hour	8 Hours	24 Hours	72 Hours	168 Hours	1000 Hours
RDX	PTFE	1.03	1.00	1.00	1.02	0.91	0.99
	PVC	1.01	1.00	0.98	1.00	1.02	1.00
	SS304	0.99	0.99	1.01	1.02	1.10	0.98
	SS316	1.01	0.99	1.01	1.02	1.11	1.00
TNB	PTFE	1.01	1.00	1.00	0.98	0.95	1.01
	PVC	1.01	1.00	0.98	1.02	1.01	1.02
	SS304	0.99	1.00	1.00	1.05	1.07	1.00
	SS316	1.02	0.99	1.01	1.07	1.06	1.02
C12DCE	PTFE	1.01	0.96*	0.96*	0.94	0.91*	0.79*
	PVC	1.00	0.99	0.95*	0.96	0.95	0.90
	SS304	0.97	1.00	1.00	0.96	1.04	0.98
	SS316	0.95	0.99	1.00	1.01	0.98	0.99
T12DCE	PTFE	1.00	0.92*	0.88*	0.83	0.66	0.56*
	PVC	1.00	0.98	0.93*	1.06	0.83	0.83
	SS304	0.95*	1.00	1.00	0.96	1.11	1.00
	SS316	1.00	0.99	1.00	1.12	1.03	1.00
MNT	PTFE	1.03	1.00	0.99	0.99	0.90	0.90*
	PVC	1.02	1.00	0.98	1.05	0.99	0.94
	SS304	1.00	1.00	1.01	1.00	1.08	1.07
	SS316	1.02	1.00	1.02	1.08	1.10	0.99
TCE	PTFE	1.00	0.90*	0.85*	0.78*	0.64*	0.40*
	PVE	1.01	0.98	0.94*	0.99	0.94*	0.88*
	SS304	0.96	1.00	1.01	0.96	1.04	0.99
	SS316	1.00	0.99	1.00	1.04	0.98	1.00
CLB	PTFE	1.01	0.93*	0.90*	0.85*	0.74*	0.51*
	PVC	1.01	0.98	0.95*	0.98	0.94*	0.86*
	SS304	0.98	1.00	1.00	0.97	1.05	0.99
	SS316	0.99	0.99	1.01	1.04	0.98	0.99
ODCB	PTFE	1.01	0.91*	0.88*	0.81*	0.68*	0.43*
	PVC	1.02	0.97*	0.94*	0.98	0.93	0.86*
	SS304	0.98	0.99	1.00	0.99	1.04	1.00
	SS316	1.01	0.98*	1.01	1.03	0.98	1.00
PDCB	PTFE	0.92*	0.84*	0.77*	0.64*	0.47*	0.26*
	PVC	0.95	0.95*	0.92*	0.97	0.88*	0.80*
	SS304	0.91*	0.98	1.00	0.98	1.02	1.02
	SS316	0.94	0.97*	1.00	1.04	0.97	1.02
MDCB	PTFE	1.00	0.84*	0.78*	0.66*	0.48*	0.26*
	PVC	1.02	0.95*	0.92*	0.97	0.88*	0.80*
	SS304	0.99	0.96*	1.00	0.99	1.02	1.02
	SS316	1.03	0.96*	1.00	1.04	0.96	1.01

[1] Values are determined by dividing the mean concentration of a given analyte at a given time and for a particular well casing by the mean concentration (for the same analyte) of the control samples taken at the same time.

* Values significantly different from control values ($\alpha = 0.05$)

of the 1000-hour samples, the vials were emptied and the pieces of casing were rinsed with approximately 40mL of fresh well water to remove any residual solution adhering to the surfaces. The casing pieces were then placed in new vials, and fresh unspiked well water was added. The vials were capped with new caps and allowed to equilibrate for three days. Aliquots were then taken from these samples and analyzed to determine if desorption had occurred.

In the second experiment 2.0 g/L of NaCl was also added to the test solution to determine the effect of increased ionic strength on the rates of sorption. Sampling times were the same except that the last samples were taken after approximately 1200 hours (seven weeks).

All analytical determinations were made by reversed-phase high performance liquid chromatography. A modular system was employed that consisted of a Spectra Physics SP 8810 isocratic pump, a Dynatech LC-241 autosampler with a 100-μL loop injector, a Spectra-Physics SP8490 variable wavelength UV detector set at 210 nm, a Hewlett-Packard 3393A digital integrator, and a Linear model 555 strip chart recorder. Separations were obtained on a 25cm x 4.6mm (5 μm) LC-18 column (Supelco) eluted with 1.5 mL/min of 62/38 (v/v) methanol-water. Baseline separation was achieved for all 10 analytes. Detector response was obtained from the digital integrator operating in the peak height mode. Analytical precision ranged from 0.4 to 3.98 percent, as determined by the pooled standard deviation of triplicate initial measurements.

For each analyte and sample time, a one-way analysis of variance (ANOVA) was performed to determine if the well casing material had a significant effect on analyte concentration. Where significant differences were found, Duncan's multiple range test was performed to determine which samples were significantly different from the controls.

Before the two experiments described previously were performed, a preliminary leaching study was conducted to determine if any substances that could interfere with the analytical determinations leached from the casing materials. For this study, two pieces of each type of well casing were placed in each of two vials. The vials were filled with fresh well water so that there was no headspace, capped and allowed to sit for one week. An aliquot was taken from each vial and analyzed. No detectable peaks were observed in any of the samples.

Results and Discussion

The data for the first experiment are summarized in Table 3, where the normalized concentrations for solutions containing well casings are given as a function of time. Neither type of stainless steel casing affected the concentrations of any of the analytes in solution. However, significant loss of solute did occur in the solutions that contained plastic casings. While the rate of loss differed dramatically from analyte to analyte, losses were always greater for PTFE than PVC.

For RDX and TNB there was no loss of analyte from solutions containing either plastic casing, even after 1000 hours. There was some loss of MNT in the sample solutions that contained PTFE casings but the loss only became significant after 1000 hours (10 percent loss); there was no loss with the PVC casings. TDCE was lost much more readily in samples containing PTFE casings than was its isomer pair, CDCE (Figure 5). (The solid lines shown in this figure and Figures 6-9 were fitted manually.) Figure 6 shows the losses of TCE for the four well casings. Figure 7 shows the rate of loss of the three DCB isomers and CLB in the samples that contained PTFE casings. The order of loss was PDCB and MDCB > ODCB > CLB. While the rate of loss did not exceed 10 percent in eight hours for any of the previous solutes, it is noted that losses of PDCB and MDCB were 16 percent in eight hours and thus were rapid enough to be of concern with respect to ground

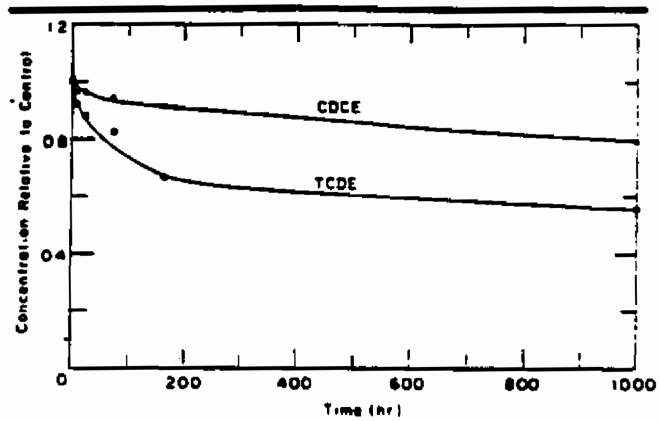

Figure 5. Sorption of CDCE and TDCE by PTFE well casings.

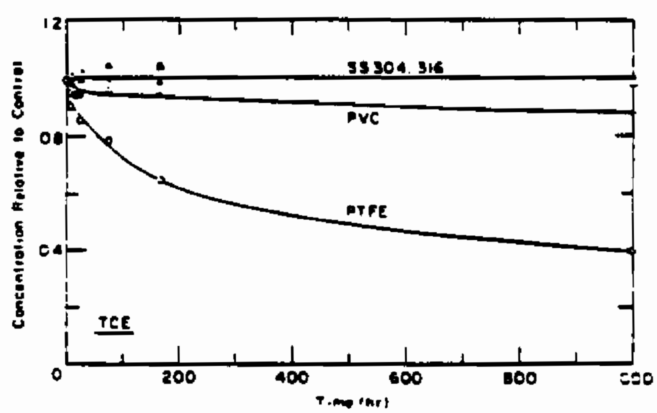

Figure 6. Sorption of TCE by the four well casing materials.

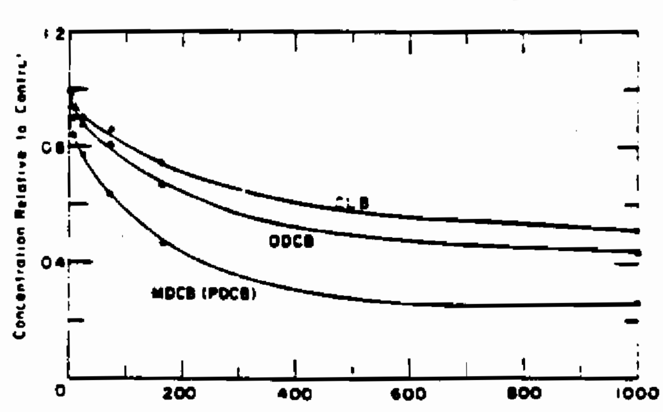

Figure 7. Sorption of CLB, ODCB, MDCB and PDCB by PTFE well casings.

TABLE 4
Results of Desorption Study

Casing Material	RDX	TNB	CDCE	TDCE	MNT	TCE	CLB	ODCB	PDCB	MDCB
	Concentration in mg/L after three days equilibration									
Teflon	ND	ND	0.20	0.43	0.075	0.47	0.28	0.38	0.30	0.35
	ND	ND	0.21	0.45	0.076	0.48	0.28	0.35	0.34	0.36
	ND	ND	*	*	0.074	*	*	*	*	*
PVC	ND	ND	0.079	0.15	0.046	0.14	0.10	0.15	0.17	0.18
	ND	ND	0.080	0.14	0.046	0.14	0.10	0.15	0.16	0.21
	ND	ND	0.080	0.15	0.043	0.13	0.11	0.16	0.16	0.20

* Results not presented because of additional loss of volatiles, probably resulting from a loose cap on this vial.
ND = Not detected.

water monitoring. For PVC, losses never reached 10 percent in eight hours for any of the organics tested, and thus the authors believe that PVC is clearly superior to PTFE for wells where water samples will be analyzed for organic constituents.

To determine if the loss of organic solutes was reversible, the pieces of casing that had been exposed to test solution for 1000 hours were rinsed and then exposed to fresh well water for three days. Measurable quantities of all the organics were recovered where significant losses had been observed (Table 4). Thus, loss was due to sorption and was at least partially reversible. Although this experiment did not give us information on the kinetics of desorption, the amount of analyte desorbed after three days generally paralleled the amount sorbed. However, PDCB and MDCB were sorbed to the greatest extent while TCE and TDCE were desorbed to the greatest extent. Therefore, it may be that diffusion out of the polymer is more rapid for smaller molecules.

In the second experiment NaCl was added to raise the chloride concentration above 1000 mg/L. High chloride concentrations are known to corrode 304 stainless steel. Specifically, tests were performed to determine if rusting would alter the sorptivity of the stainless steel surfaces. It is also possible that sorption on plastic materials would change with increasing ionic strength of the test solution.

While addition of NaCl caused rapid rusting of both stainless steel casings (<24 hr), it did not cause sorption of any of the organic solutes by them. In addition, the increased ionic strength had no detectable effect on the rate of sorption by either plastic casing (for example, Figures 8 and 9). These two figures also demonstrate the excellent reproducibility of the results from these two experiments.

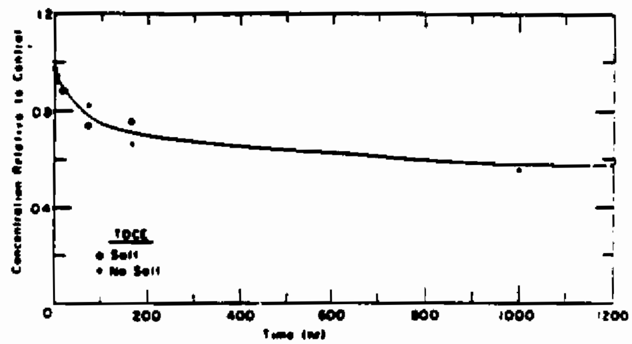

Figure 8. Sorption of TDCE by PTFE well casings in the presence and absence of salt.

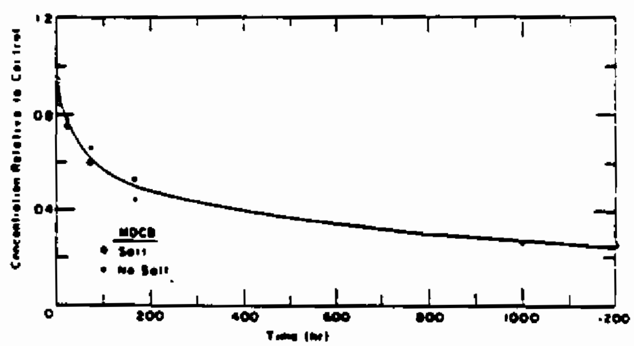

Figure 9. Sorption of MDCB by PTFE well casings in the presence and absence of salt.

Modeling the Sorption Process

These organic studies clearly demonstrated that the loss of organic chemicals from solutions exposed to plastic casing materials is via some reversible sorption process. However, it was uncertain whether this loss was due to sorption on the surface or whether there was penetration into the polymer matrix. The rate of sorption was found to be slow, with no established equilibrium after hundreds of hours. One explanation for this slow rate was that penetration into the polymer was occurring, with the rate controlled by slow diffusion within the bulk polymer and/or the rate of penetration into the small pores on the polymer surface. If it is assumed that this is the case, the process can be kinetically modeled by treating the plastic casing as an immiscible liquid phase in contact with water and relating the degree of partitioning for individual analytes to their octanol/water partition coefficients (K_{ow}). While there are immiscible liquids other than octanol that are better structural models for PTFE or PVC, the most extensive collection of partition coefficients is available for octanol.

If it is assumed that sorption is a reversible process,

$$A_w \underset{k_2}{\overset{k_1}{\rightleftharpoons}} A_s \ , \tag{1}$$

and is first order in both directions, then the rate equation can be written as (Gould 1959):

$$\frac{d[A_w]}{dt} = -k_1 [A_w] + k_2 [A_s] \tag{2}$$

where $[A_w]$ is the concentration of solute A in aqueous solution, $[A_s]$ is the concentration of solute A in the plastic casing material, and k_1 and k_2 are the first-order rate constants for sorption and desorption, respectively.

Integration of the rate equation results in a nonlinear relationship for A_w as a function of time t and two constants a and b (Equation 3), where a and b are defined in Equations 4 and 5:

$$\frac{\ln (a[A_w] + b)}{a} = t \tag{3}$$

$$a = k_1 + k_2 \tag{4}$$

$$b = 10k_2 [A_o] \tag{5}$$

where A_o is the initial concentration of solute A in aqueous solution.

Optimal values for a and b were obtained for each solute exposed to PTFE by application of the Gauss-Newton method of non-linear curve fitting using the measured concentrations at 1, 8, 24, 72, 128, and 1000 hours (Parker et al. 1989). Using determined values for a and b, the authors simultaneously solved Equations 4 and 5 for each solute to obtain estimates of k_1 and k_2. Because the process described is assumed to be reversible and first order, the ratio of the rate constants, k_1/k_2, is the equilibrium constant, K_{eq}.

When the eight values of K_{eq} were plotted vs. Log K_{ow}, six of the eight points appeared to fall on a straight line, while the points for MNT and ODCB did not (Figure 10). The poor fit for MNT and the lack of significant sorption for TNB and RDX can be explained by the tendency of nitro-containing organic molecules to form strong hydrogen bonds, which keeps them in solution. While octanol can be a donor in hydrogen bonding, PTFE cannot. Thus, if the authors predict partitioning into PTFE for these molecules based on their octanol/water coefficients, the amount of sorption for these types of compounds will be overestimated.

The poor prediction for ODCB can be explained by the well-documented "ortho effect," which is a complex combination of electronic and steric interactions that often results in ortho di-substituted aromatic molecules behaving much differently than the meta- and para-isomers.

A similar model predicting the loss of analyte for PVC was not created because the percent sorbed was small when compared with the experimental error and this would produce an unacceptable degree of uncertainty in the calculated rate constants.

Therefore, it is concluded that for hydrophobic

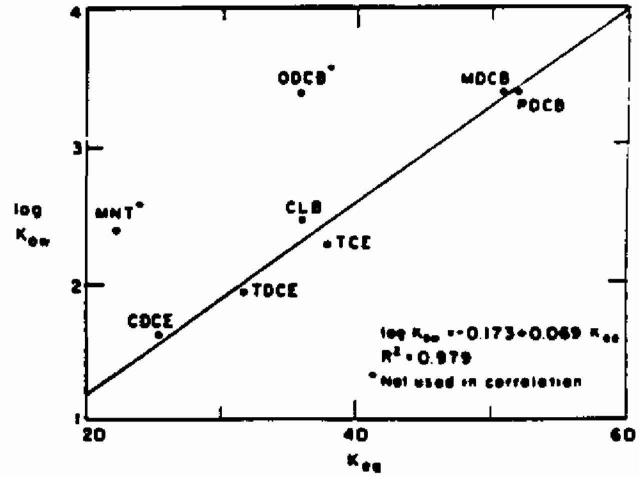

Figure 10. Correlation between log K_{ow} and K_{eq} for solutes exposed to PTFE casings.

organic molecules that are not subject to hydrogen bonding, the relationship presented in Figure 10 can be used to estimate the equilibrium partitioning of an analyte between the aqueous phase and PTFE. It is expected that losses in new wells would occur for some time until equilibrium with the water is achieved.

While K_{eq} will determine the equilibrium concentrations of each analyte in the water and plastic phases, it is the magnitude of k_1 that will determine how quickly various analytes are depleted. For small, planar molecules like TCE, the k_1 values are quite high compared to the other analytes. This may explain the rapid loss of tetrachloroethylene from solutions containing PTFE casings observed by Miller (1982) and Reynolds and Gillham (1986).

Because the rate of sorption appears to be first order, the relative concentration (concentration at a given time relative to its initial concentration) is independent of initial concentration (Castellan 1964). Thus, the percent loss at a given exposure time is expected to be independent of concentration, as was also predicted by the model of Reynolds and Gillham (1986). We did not confirm this, however, by conducting the test at several concentrations.

For further details on the organic portion of this study, refer to Parker et al. (1989).

Summary and Conclusions

In summary, the inorganic study indicated that three of the metals (As, Cr and Pb) were sorbed by one or more of the casing materials. Specifically, Cr was sorbed by SS 316 casings, As was sorbed by both 304 and 316 stainless steel casings, and Pb was sorbed by all four casings. On the other hand, Cd leached from the stainless steel and PVC casings, although subsequent sorption lowered concentrations in the samples containing stainless steel casings. While sorption of As was slow enough that it is probably not of concern for ground water monitoring, the changes in the Cr, Cd and Pb concentrations are of concern. Both SS 304 and 316 casings were subject to surface oxidation, presumably by galvanic action, which apparently provided active sites for sorption and release of major and minor constituents. Sorption and leaching of metal species was affected in some cases by the ground water composition (pH and organic carbon content). Specifically, there was more leaching of Cd and less sorption of Pb at the lower pH. Our results indicate that humic material may have acted as a complexing agent, making lead and chromium less prone to sorption. If chemical interactions are used as the only criterion, PTFE is clearly the best candidate for monitoring metal species in ground water. PVC would be a good second choice because its performance was considerably better than either SS 304 or SS 316 casing.

In contrast, the organic studies clearly indicated that PTFE was the poorest choice of the four well casing materials tested. PTFE casings sorbed all the chlorinated compounds and one nitroaromatic compound, and losses of PDCB and MDCB were rapid enough to be of concern for ground water monitoring. PVC casings also sorbed some of the same compounds, but always at rates that were considerably slower than those observed for PTFE casings. The rates of these losses on PVC were slow enough that they did not appear to be of concern for ground water monitoring. There was no loss of any of the organic solutes in the presence of either type of SS casing.

The desorption study showed that the loss of organics from aqueous solution is due to a sorption process that was reversible, or at least partially so. Desorption from contaminated casings could potentially result in falsely high concentrations of analytes if the concentrations of the analytes in the ground water were to drop.

The loss of hydrophobic organic constituents in the samples containing PTFE casings could be correlated with the substance's K_{ow} values. However, this correlation overestimates losses for hydrophilic organic substances.

There are several effects that make extrapolating these test data to a real monitoring situation difficult:

- Casings were tested and not well screens. The rate of sorption could be substantially greater in the screened portions of the well because the surface area of the screened portion would be greater.
- This experiment was conducted under static conditions. The effect of sorption under real conditions would be mitigated to some degree, depending on the rate of exchange of water between the aquifer and well casing.

Clearly, choosing one casing material for samples that will be analyzed for both trace metals and organics involves compromise. However, based on the results of the tests that the authors have performed to date, PVC appears to be the best compromise choice of the four casing materials tested.

Future studies will examine leaching of inorganic and organic solutes, the effect of low dissolved oxygen on interactions between the metals and well casings, and the suitability of other materials for ground water monitoring.

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Potential of Common Well Casing Materials to Influence Aqueous Metal Concentrations

by Alan D. Hewitt

Abstract

Static leaching and sorption laboratory studies were performed to assess the potential of polyvinyl chloride (PVC), polytetrafluoroethylene (PTFE), and two types of stainless steel (SS 304 and SS 316) well casing materials to influence metal concentrations in ground water solutions with low dissolved oxygen. Overall, PTFE was inert, whereas one or both stainless steels significantly altered the solution concentrations of Cd, Cr, Cu, Pb, Fe, and Ni. PVC was generally more reactive than PTFE, but did not significantly alter the solution metal concentrations as often, or as greatly, as either of the stainless casings.

Introduction

The validity of estimates of analyte concentration in ground water samples collected from monitoring wells has recently received considerable attention. This issue, with regard to the selection of a monitoring well construction material, stems from the U.S. Environmental Protection Agency (U.S. EPA) recommendation that stainless steel and polytetrafluoroethylene (PTFE) be used instead of polyvinyl chloride (PVC) when volatile organic compounds will be analyzed during the well's lifetime (U.S. EPA 1986). Because screening for all hazardous waste analytes regulated by the U.S. EPA must be performed at least once, this recommendation is interpreted by some agencies as prohibiting the use of PVC.

A review of the literature published prior to 1986 reveals no substantial evidence (nor were any references provided in U.S. EPA [1986]) for the basis of this decision. Subsequent well casing studies concerned with material effects on solution analyte concentration have observed the following. During ground water sample collection from steel and stainless steel (SS) wells under stagnant condition and after purging, leaching of Fe, Cd, Cr, and Mn has been observed (Houghton and Berger 1984, Barcelona and Helfrich 1986). Laboratory studies monitoring the metals listed in the National Interim Primary Drinking Water Regulations (NIPDWR, Table 1), found either or both SS 316 and SS 304 to affect the solution concentration of Ba, Cr, Cu, and Pb, while PVC and PTFE were far less influential (Hewitt 1989, Parker et al. 1990). Laboratory studies concerned with organic analytes (Gillham and O'Hannesin 1988, Parker et al. 1990, Reynolds et al. 1990) reported that sorption of several halogenated compounds (i.e., tetrachloroethylene) was more rapid for PTFE than PVC. Although none of these studies can predict the actual effects that will be incurred when sampling from a well, they do address the issue of material inertness. As the time between well purging and sampling diminishes, so does the issue of well casing material effects (Nielsen 1988).

In this study, leaching and sorption experiments were performed comparing PVC, PTFE, SS 304 and SS 316 well casing materials in low dissolved oxygen (DO) solutions. The low DO condition was imposed to eliminate the development of visible surface oxidation on the stainless casings. In previous studies (Hewitt 1989, Parker et al. 1990) roughly half of the stainless steel casings developed rust sites. Surface oxidation, presumably by galvanic action, could explain the significant effects observed for the stainless steels. In addition, the low-DO condition addresses the anoxic conditions common to very deep wells, where material strength requirements, combined with U.S. EPA material recommendations, currently limit well casing selection to only the stainless steels.

Materials and Methods

Materials

Sections of PVC, PTFE, SS 304, and SS 316 well casings (1.2m long, 5.0cm I.D.) specifically manufactured (factory cleaned) for ground water monitoring

TABLE 1
National Interim Primary Drinking Water Regulation Levels (*Federal Register* 1975)

Metal	NIPDWR Levels (μg/L)
As	50
Ba	1000
Cd	10
Cr	50
Pb	50
Hg	2
Se	10
Ag	50

were cut in approximately 2cm lengths. The exact lengths of the casing rings were adjusted based on the pipe's diameter and wall thickness to normalize the surface area (80 cm^2). During pipe milling (cutting and edge filing), precautions were taken to prevent exposure to grease, dirt, solvents, and other foreign substances. Casing rings were individually rinsed several times prior to use with deionized distilled water, and air dried in a Class 100 clean air station. All cleaning and subsequent operations were performed within a cleanroom complex, and plastic gloves or nylon tweezers were used to handle the rings.

Polypropylene jars (69mm O.D. x 62mm high, 125mL) were used as exposure vessels for individual casing rings. These vessels and all other materials (i.e., collection bottles, tubing, etc.) that came into contact with the well water were appropriately cleaned with either dilute nitric acid or soap and water followed by several rinses with deionized distilled water. A glove bag served as the nitrogen environmental chamber for these low-DO experiments. The ground water used here and previously (Hewitt 1989, Parker et al. 1990) was collected from a 76m-deep domestic artesian well located in Weathersfield, Vermont.

Test Design and Setup

Experiments designed to study both the sorption and leaching of metals were performed in a positive nitrogen atmospheric chamber. Low dissolved oxygen water was created by purging with nitrogen, thereby lowering this constituent from its native level of 9.0 mg/L to below 1.0 mg/L (Table 2). In the leaching experiment, the metals analyzed were Cd, Cr, Cu, Pb, Fe, and Ni. The sorption experiment studied the solution concentrations of Cd, Cr, Cu, and Pb, introduced at concentrations that were approximately one-fifth the NIPDWR (Table 1). The concentration of native Fe in the water was also monitored in the sorption study. The metal analytes in this study were major constituents of stainless steel or had previously been found to be influenced by casing materials (Hewitt 1989, Parker et al. 1990). Hewitt (1991) provides a more detailed discussion of the experimental setup and procedure.

For the leaching experiment, triplicates of each casing material and the control (no casing) were prepared for treatment periods of two, eight, 24, and 120 hours. Casing rings were submerged in 60mL of water inside capped vessels. After treatment each casing ring was removed from the vessel and the remaining solution (60mL) was acidified, thus sacrificing the sample and vessel. This sample collection method was deemed necessary for the leaching study, because released metals, particularly cations, could be lost to the plastic vessel walls (Masse et al. 1981). In addition to the samples and control, four additional vessels without well casings were included, one for each exposure period, to monitor pH, DO, and oxidation/reduction potential (ORP).

The sorption study followed this same experimental design, with triplicates of the four casing materials and the control, and a vessel for monitoring the solution parameters for each treatment period. Here, sample aliquots of 2.5mL were removed and acidified after two, eight, 24, and 72 hours of treatment, from an initial solution volume of 100mL. Sample aliquots could be removed in this fashion because the controls could account for the loss of metals to the vessel walls.

Analysis

Metal analyses were performed using Graphite Furnace Atomic Absorption (GFAA) with a Perkin-Elmer

TABLE 2
Ground Water Parameters Measured In Situ and for Experimental Monitoring Solutions

	DO (mg/L)	pH	ORP (mV)	Conductance (μmhos)
In situ ground water	9.0	7.4	280	*230
Leaching experiment monitoring solutions				
Stock	0.4	8.4	190	240
2 hr	1.3	8.4	180	—
8 hr	1.2	8.4	180	—
24 hr	1.7	8.7	180	—
120 hr	0.6	8.9	170	—
Sorption experiment monitoring solutions				
Stock	0.9	8.1	200	—
2 hr	1.8	8.1	—	—
8 hr	1.6	8.1	190	—
24 hr	0.8	8.5	170	—
72 hr	0.3	8.9	150	—

*Conductivity of ground water measured just prior to purging.

TABLE 3

Summary of Statistical Analyses for Average Analyte Concentrations (μg/L) During the Leaching Experiment. (Materials with common underlining are not different at the 95 percent confidence level as determined by the least significant difference [LSD].)

Static Leaching Experiment

Cadmium

Time	Well Casing					
2 hr	Control	PTFE	PVC	SS 304	SS316	
	0.03	0.04	0.10	0.22	0.36	(LSD = 0.16)
8 hr	Control	PTFE	PVC	SS 304	SS 316	
	0.03	0.03	0.22	0.40	0.49	(LSD = 0.36)
24 hr	Control	PTFE	SS 304	SS 316	PVC	
	0.03	0.03	0.17	0.20	0.27	(LSD = 0.29)
120 hr	Control	PTFE	SS 316	SS 304	PVC	
	0.03	0.03	0.04	0.09	0.24	(LSD = 0.28)

Chromium

Time	Well Casing					
2 hr	Control	PTFE	SS 304	PVC	SS 316	
	0.24	0.28	0.62	0.72	1.35	(LSD = 1.12)
8 hr	Control	PTFE	PVC	SS 316	SS 304	
	0.29	0.35	0.38	2.04	4.44	(LSD = 5.91)
24 hr	Control	PTFE	PVC	SS 316	SS 304	
	0.28	0.30	0.68	1.89	2.29	(LSD = 2.59)
120 hr	PTFE	Control	PVC	SS 316	SS 304	
	0.34	0.37	0.38	2.19	3.06	(LSD = 3.25)

Copper

Time	Well Casing					
2 hr	Control	PTFE	PVC	SS 304	SS 316	
	0.47	1.13	1.85	6.90	31.2	(LSD = 11.5)
8 hr	Control	PTFE	PVC	SS 304	SS 316	
	0.49	0.73	1.44	5.02	25.3	(LSD = 15.3)
24 hr	Control	PTFE	PVC	SS 304	SS 316	
	0.50	0.70	2.35	8.09	20.0	(LSD = 8.67)
120 hr	Control	PTFE	PVC	SS 304	SS 316	
	0.49	0.99	1.66	3.56	16.2	(LSD = 7.02)

Lead

Time	Well Casing					
2 hr	Control	PTFE	SS 304	SS 316	PVC	
	0.10	0.14	0.55	0.79	0.94	(LSD = 0.98)
8 hr	Control	PTFE	PVC	SS 316	SS 304	
	0.10	0.18	0.36	0.95	6.58	(LSD = 11.7)
24 hr	Control	PTFE	SS 316	PVC	SS 304	
	0.10	0.18	0.27	0.93	1.42	(LSD = 0.59)
120 hr	Control	PTFE	SS 316	PVC	SS 304	
	0.10	0.12	0.34	0.36	1.65	(LSD = 0.55)

Iron

Time	Well Casing					
2 hr	Control	PTFE	PVC	SS 304	SS 316	
	9.93	11.4	12.0	16.7	22.7	(LSD = 7.65)
8 hr	Control	PVC	PTFE	SS 304	SS 316	
	9.77	11.0	13.4	14.9	55.6	(LSD = 85.8)
24 hr	PTFE	Control	PVC	SS 304	SS 316	
	9.50	9.80	11.5	20.0	28.9	(LSD = 16.1)
120 hr	PVC	PTFE	Control	SS 316	SS 304	
	9.10	9.60	10.0	17.1	48.2	(LSD = 40.8)

Nickel

Time	Well Casing					
2 hr	Control	PVC	PTFE	SS 304	SS 316	
	2.2	2.2	2.4	3.2	13.5	(LSD = 6.9)
8 hr	Control	PTFE	PVC	SS 304	SS 316	
	2.2	2.2	2.2	3.52	16.0	(LSD = 5.2)
24 hr	Control	PTFE	PVC	SS 304	SS 316	
	2.2	2.2	2.2	5.0	10.4	(LSD = 3.0)
120 hr	Control	PVC	PTFE	SS 304	SS 316	
	2.2	2.2	2.4	6.1	12.0	(LSD = 8.7)

Model 403 Atomic Absorption Spectrophotometer (AAS) coupled with a Perkin-Elmer Model 2200 heated graphite atomizer. Instrumental procedures followed the guidelines provided in the manufacturer's instrument manual (Perkin-Elmer 1981). The analytical procedures were designed to achieve method detection limits (MDLs) below 1 percent of the NIPDWR levels (Table 1). The MDLs were established as described in the *Federal Register* (1984).

Dissolved oxygen, pH, and ORP were determined spectrophotometrically using high-range AccuVac reagent vials (Hach 25150) and a Dr/2 spectrometer (Hach), with a semimicro glass combination Ross Model 81-03 electrode (Orion), and with a Model 97-78-00 platinum redox electrode (Orion), respectively.

For each experiment and metal the data for the sample triplicates of each casing material and control were subjected to a one-way analysis of variance (ANOVA) and a least-significant-difference (LSD) test at the 95 percent confidence level.

Results

Leaching Experiment

Table 3 shows the results for the statistical analyses of the Cd, Cu, Cr, Pb, Fe, and Ni concentrations determined. PTFE was not observed to leach any of the metals determined, relative to the control. PVC leached significantly more Pb for the 24-hour treatment period, while SS 304 leached more Pb for the 24- and 120-hour treatment periods and more Cd for the two- and eight-hour treatment periods, relative to PTFE and the control. Stainless steel 316 leached significantly more Cd for two- and eight-hour treatment periods, and frequently leached more Cu, Fe, and Ni in comparison to PTFE, PVC, and the control. Ranking the materials based on their tendency to leach the metals studied shows that PTFE < PVC < SS 304 << SS 316.

Sorption Experiment

Table 4 shows the results of the statistical analyses for the spiked metals and native Fe. This analysis did not reveal any statistically significant differences between PTFE and the control or between PVC and PTFE. Stainless steel 316 showed significant leaching of Cu and sorption of Pb for three out of four treatment periods, while SS 304 sorbed more Cd, Cr, and Pb for at least half the treatment periods relative to PTFE, PVC, and the control. Ranking the materials based on their ability to sorb the metals studied shows that PTFE < PVC < SS 316 << SS 304.

Discussion

From the time of ground water collection to the end of each of the experiments there were shifts in chemical equilibria. The low DO condition, however, did prevent visible surface oxidation from forming on the stainless steel casings, as was observed in our earlier studies (Hewitt 1989, Parker et al. 1990). The DO in earlier efforts was around 9.0 mg/L, the same as the in situ concentration determined for this study (Table 2). This high level of DO has previously been cited as being corrosive (Aller et al. 1989).

Assessing first those metals that are major constituents of one of the materials tested reveals the expected: the two stainless casings leached Fe, Ni, and Cr (Table 3), and SS 304 sorbed Cr (Table 4). Clearly, samples that are to be analyzed for a given analyte should not be exposed to materials containing that analyte.

With regard to the aqueous concentrations of Cd, Cu, and Pb, PTFE was the least reactive material, and the stainless steels the most reactive in terms of releasing or providing sites for sorption. This finding is also consistent with earlier laboratory studies (Hewitt 1989, Parker et al. 1990), indicating that independent of visible corrosion, active sites exist on stainless steel casings that can either release or sorb metals of concern to human health.

Common to these experiments and our previous studies (Hewitt 1989, Parker et al. 1990) were aberrant aqueous metal concentrations determined for individual samples that could be treated as outliers. In all cases the aberrant concentrations were found in samples exposed to the stainless steel casings. This frequently resulted in variances that were not homogeneous with the other casing materials. The comparison of inhomogeneous variances weakens the statistical analysis, making the interpretation overly conservative. This explains why significant differences were not distinguished in some cases where the mean concentrations were numerically different by as much as an order of magnitude. The author has chosen to handle the data in this fashion because, in his opinion, the aberrant values were not random, but inherent to the stainless steel casing material.

The application of static laboratory findings to the dynamic and environmentally sensitive conditions that exist for sampling ground water is not straightforward. However, because the two-hour treatment period showed significant leaching by both stainless steel casings and sorption by both stainless steel and PVC (Pb only) casings (Table 5), the potential material effects demonstrated here cannot be easily dismissed with respect to the time lapse between purging and sampling.

Conclusion

If only metal analytes are of concern, PTFE is the best material for ground water monitoring wells with respect to material inertness. Ground water samples analyzed for trace metals would be more suspect if taken from wells constructed with stainless steel than if taken from wells made of either PVC or PTFE. This finding holds for both corrosive (Hewitt 1989, Parker et al. 1990) and non-corrosive environments. Studies concerned with levels of aqueous organic constituents have shown PTFE to be more prone to sorption of analytes than either PVC or stainless steel (Gillham and O'Hannesin 1988, Parker et al. 1990, Reynolds et al. 1990). In terms of a material's inertness, PVC is the best compromise among those tested here, for monitoring wells installed to monitor trace levels or for the early detection of contaminants in ground water.

TABLE 4

Summary of Statistical Analyses for Average Analyte Concentrations (μg/L) During the Sorption Experiment. (Materials with common underlining are not different at the 95 percent confidence level as determined by the least significant difference [LSD].)

Sorption Experiment

Cadmium

Time	Well Casing					LSD
2 hr	SS 304	PTFE	Control	PVC	SS 316	
	2.18	2.24	2.28	2.28	2.31	(LSD = 0.12)
8 hr	SS 304	SS 316	PVC	PTFE	Control	
	1.85	2.16	2.19	2.22	2.25	(LSD = 0.20)
24 hr	SS 304	SS 316	PVC	PTFE	Control	
	1.48	1.96	2.11	2.19	2.23	(LSD = 0.29)
72 hr	SS 304	PVC	SS 316	Control	PTFE	
	0.82	1.27	1.46	2.04	2.13	(LSD = 1.42)

Chromium

Time	Well Casing					LSD
2 hr	SS 304	PTFE	Control	PVC	SS 316	
	11.3	12.1	12.2	12.3	12.4	(LSD = 0.79)
8 hr	SS 304	PTFE	Control	SS 316	PVC	
	10.7	12.1	12.1	12.2	12.4	(LSD = 1.36)
24 hr	SS 304	Control	PTFE	PVC	SS 316	
	10.5	12.2	12.2	12.4	12.5	(LSD = 1.45)
72 hr	SS 304	SS 316	Control	PTFE	PVC	
	8.36	11.4	11.9	12.1	12.5	(LSD = 4.36)

Copper

Time	Well Casing					LSD
2 hr	PTFE	Control	PVC	SS 304	SS 316	
	10.4	10.5	10.8	12.2	23.2	(LSD = 7.42)
8 hr	SS 304	PTFE	PVC	Control	SS 316	
	9.33	9.93	10.2	10.7	27.6	(LSD = 7.55)
24 hr	SS 304	PVC	PTFE	Control	SS 316	
	6.84	9.41	9.61	9.91	30.0	(LSD = 7.39)
72 hr	SS 304	PVC	PTFE	Control	SS 316	
	4.48	6.24	8.75	9.38	18.9	(LSD = 10.9)

Lead

Time	Well Casing					LSD
2 hr	SS 316	SS 304	PVC	PTFE	Control	
	8.56	8.73	9.32	9.83	10.1	(LSD = 0.61)
8 hr	SS 316	SS 304	PVC	PTFE	Control	
	5.17	5.73	8.49	9.54	9.98	(LSD = 1.45)
24 hr	SS 316	SS 304	PVC	PTFE	Control	
	2.94	3.65	7.98	9.11	9.62	(LSD = 2.05)
72 hr	SS 316	SS 304	PVC	Control	PTFE	
	1.64	2.26	4.45	8.42	8.51	(LSD = 4.50)

Iron

Time	Well Casing					LSD
2 hr	PVC	Control	PTFE	SS 316	SS 304	
	8.76	9.11	10.9	13.2	19.6	(LSD = 16.9)
8 hr	Control	PTFE	PVC	SS 316	SS 304	
	8.66	8.71	8.97	12.3	19.6	(LSD = 17.1)
24 hr	PTFE	PVC	Control	SS 316	SS 304	
	7.75	8.31	8.08	11.8	18.9	(LSD = 15.6)
72 hr	PTFE	PVC	Control	SS 316	SS 304	
	6.91	6.93	7.35	9.89	11.3	(LSD = 6.61)

TABLE 5
Well Casing Material(s) that Leached or Sorbed a Significantly Greater Amount Relative to the Control, for a Two-Hour Treatment Period

	Metal Influenced					
	Fe	Ni	Cd	Cu	Cr	Pb
Leached	SS 316 SS 304	SS 316	SS 316 SS 304	SS 316	—	—
Sorbed	—	—	—	—	SS 304	SS 316 SS 304 PVC

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Biographical Sketch

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Information Requirements for Justification of Alternative Well Casing Materials for Groundwater Monitoring Well Construction

I. EPA Region IV requires that groundwater monitoring wells be constructed of stainless steel (304 or 316 - first choice) or rigid PVC meeting NSF Standard 14 ("NSF WC" - second choice). Which of these well casing materials to be used depends upon which would obtain the most representative groundwater sample. A justification must be submitted when monitoring wells constructed of PVC materials are proposed for use in collecting samples for organic analysis. Following are EPA's information requirements for justifying the use of PVC as the well casing material for groundwater monitoring wells.

1. The Data Quality Objectives (DQO) for the samples to be collected from wells with PVC casing per EPA/540/G-87/003, Data Quality Objectives for Remedial Response Activities.

2. The anticipated compounds and their concentration ranges.

3. The anticipated residence time of the sample in the well.

4. The aquifer's productivity.

5. The reasons for not using hybrid wells of PVC casings and stainless steel screens.

6. Brief discussion of adsorption/desorption characteristics of the compounds and elements of interest for the type of PVC to be used.

7. Whether an anticipated increase in thickness of the monitor well wall would require a larger annular space.

8. The type of PVC to be used and, if available, the manufacturer's specifications. Additionally, assurance that the PVC to be used does not leach, mask, react or otherwise interfere with the contaminants being monitored within the limits of the DQOs.

II. EPA acceptance of PVC well casing materials does not constitute approval of that casing material; therefore, if PVC is accepted for use, the following conditions shall apply:

1. The FACILITY accepts the risks that the use of alternate materials for groundwater monitoring may cause interferences or inaccuracies in the chemical analysis of samples from such wells. All compounds found in samples collected from the well will be considered to originate in the aquifer being monitored.

2. Any such acceptance applies to the implementation of the specified RFI Work Plan only, and any other use of alternate materials for groundwater monitoring must be granted by EPA separately.

3. Any major amendments or revisions to the referenced RFI Work Plan or the intended DQOs of the work plan may require reassessment of the acceptance for use of alternate materials by EPA.

4. EPA reserves the right to refuse groundwater monitoring data from groundwater wells constructed of alternate materials from those specified in the Region IV SOP whenever such construction materials could cause the ground water monitoring data to fail to meet the necessary DQOs.

III. The information to justify the use of PVC well casing could be incorporated into the work plan and be inclusive for all sites where PVC casing will be used.

IV. All field work and laboratory procedures must follow EPA Region IV Standard Operating Procedure Quality Assurance Manuals (SOPQAM). The SOPQAM for field procedures is dated February 1991, and the SOPQAM for laboratory procedures is dated September 1990. Any deviation from EPA Region IV SOPQAM must be justified in writing and be approved by EPA.

August 2. 1991

APPENDIX S

E/A & H CORPORATE *HEALTH AND SAFETY MANUAL*

Health and Safety Manual

Prepared by

Environmental and Safety Designs, Inc.

5724 Summer Trees Drive
Memphis, Tennessee 38134

RECEIPT AND UNDERSTANDING OF

HEALTH AND SAFETY POLICIES AND PROGRAMS

I, ______________________________, have read the Environmental and Safety Design, Inc. Health and Safety Manual. In doing so, I understand its contents and, hereby, agree to abide by the policies and procedures contained within. Furthermore, I understand that failure to comply with those policies and procedures and all other established safety policies and procedures may result in disciplinary action up to and including termination of employment.

Signature ____________________________ Date______________

Introduction: Health and Safety Policy for Environmental and Safety Designs, Inc.

Conducting investigations and cleanup operations of hazardous materials in the workplace and environment adds a new dimension to the practice of occupational health and safety. Considerations beyond those of the typical industrial setting must be made to incorporate the special conditions encountered when handling these materials. Employees involved in investigation or cleanup of hazardous materials can be exposed to numerous toxic and hazardous substances that may or may not be identified, and for which the potential health effect may not be known.

To preclude the occurrence of harmful exposures, Environmental and Safety Designs, Inc. (EnSafe) is firmly committed to establishing safe and healthful work conditions and practices at each of its job locations. To assure that EnSafe is successful in this endeavor requires a concentrated effort on the part of management and all employees. EnSafe management is responsible for keeping abreast of and disseminating information pertaining to current laws, regulations, and standards regarding the health and safety of employees exposed to hazardous materials. EnSafe will take the necessary steps to recognize, evaluate, and control those situations likely to produce exposures to hazardous materials through the diligent review of work and safety plans for each job site. Programs in medical surveillance, respiratory protection, and safety training are provided for EnSafe employees. The programs are administered and updated to assure the welfare of each employee. In addition, it is the responsibility of the management and technical staff to respond to questions and promptly investigate any complaints.

All EnSafe employees are expected to accept the responsibility of personal concern for the safety and health of themselves, fellow workers, and visitors through the knowledge of and compliance with company programs and policy. Employees must attend training programs and abide by established rules and procedures. EnSafe is not responsible for the health and safety of the employee who modifies, alters or otherwise uses equipment or performs work which is inconsistent with the manufacturer's instructions or established operating procedures. In addition, employees who fail to follow established health and safety plans and procedures will be subject to disciplinary action. Questions or violations should be reported to supervisors or to the Health and Safety Officer, for clarification and follow up.

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Section 1: Medical Monitoring Program

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Section 1: Medical Monitoring Program

All EnSafe personnel who enter hazardous waste/spill sites or have the potential for exposure to hazardous materials from these sites must participate in the EnSafe Medical Monitoring Program. The program is conducted by EnSafe's Company doctor in liaison with the Company Health and Safety Officer. The purpose of the program is to identify any preexisting illnesses or problems that would put an employee at unusual risk from certain exposures or respirators, and to monitor and evaluate exposure-related events where workers are involved in the handling of hazardous materials. Project managers should consult with the Health and Safety Officer and/or the Company doctor concerning the scope of work and known or anticipated chemical hazards associated with each project.

EnSafe maintains the right to exclude certain individuals from particular jobs based on reports from the Company doctor.

The program will be reviewed on an annual basis to determine its effectiveness.

The Company doctor has been employed as an independent contractor to provide medical monitoring for EnSafe. The doctor is responsible for the following aspects of the medical monitoring program:

- Selection and quality assurance of medical and laboratory services involved in carrying out the monitoring program
- Development of a uniform medical record
- Record retention
- Employee notification of examination results
- Determination of content of the medical and biological monitoring programs
- Record review and correlation between potential exposure and effect
- Monitoring job related illness and injury for each employee

1.1 Examinations

1.1.1 Preplacement Examinations

Each employee will be given a preplacement examination to identify any preexisting illness or problem that would put the employee at an unusual risk from certain exposures; to assure that each employee can safely use negative pressure respirators; and to develop a data base to assess any exposure-related events detected during periodic medical monitoring. Data accumulation will include variables such as age, sex, race, smoking, prior employment history, and other conditions that might bear upon the occurrence of subsequent events once employment begins.

The preplacement examination includes:

- Occupational history including previous chemical and carcinogenic exposures
- Medical history including demographic data, family history, personal habits, past medical history and a current symptomatic review of systems
- Fertility history
- Physical examination, stressing examination of the neurologic, cardio-pulmonary, musculo-skeletal and dermatological systems
- Physiological parameters including blood pressure and visual acuity testing
- Pulmonary function testing including FVC, FEVI and FEV 25-75
- Electrocardiogram
- PA and lateral chest X-ray
- A multi-chemistry panel including tests of kidney and liver function
- Red blood cell cholinesterase
- Audiogram

The history, physiological parameters, X-ray, screening tests and laboratory studies will be done prior to the physical examination. After the physical examination the medical examiner will review the results of the examination and special studies with each employee and facilitate referral for further evaluation of abnormalities detected during this examination. OHS will provide each employee a written summary and detailed results of the examination along with treatment of any job restrictions.

1.1.2 Periodic and Exit Examinations

An examination and updated occupational history will be repeated on an annual basis. The content of the annual examination includes:

- Updated occupational and medical history
- Physical examination, stressing examination of the neurologic, cardio-pulmonary, musculo-skeletal and dermatological systems
- Pulmonary function testing including FVC, FEVI and FEV 25-75
- Multi-chemistry panel including tests of kidney and liver function
- Urinalysis

The Company doctor will review the results of annual examination and exposure data, and request further tests or issue medical clearances as appropriate.

An examination will also be done when an employee terminates. The Company doctor will be consulted for the contents of the exam. The exception to this is when the terminating employee has had an exam within six (6) months or when there has been no site work since the time of the last examination.

1.1.3 Return-to-Work Examinations

After any job-related injury or illness, a medical examination is required to determine fitness for duty or to identify any job restrictions. The medical examiner will review the results of this back-to-work examination with the Company doctor prior to releasing the employee for work. A similar examination will be performed if an employee has missed at least three (3) days of work due to a non-job-related injury requiring medical attention.

1.2 Biological and Medical Monitoring

Biological and medical monitoring for specific exposures will be done whenever feasible. Such monitoring is important to assess the adequacy of personal protective measures and work practices. After reviewing potential exposures at any one site, the Company doctor will determine the content and frequency of a medical and biological monitoring program. The content and frequency might change as further information is acquired concerning specific environmental exposure levels.

Such a program might include:

- ❑ Measurements of specific substances such as:
  - — blood lead
  - — urine cadmium
  - — blood or urine mercury
  - — serum levels of PCBs, organochlorine compounds, etc.

- ❑ Metabolic products such as:
  - — urine azide-iodide test (carbon disulfide)
  - — urine phenol (benzene)
  - — carboxyhemoglobin (methylene chloride)

- ❑ Medical monitoring for specific exposures such as:
  - — red blood cell cholinesterase (organophosphates)
  - — quantitative urine protein (cadmium and mercury)
  - — reticulocyte count and platelet count (benzene)
  - — thyrozine (dinitrophenol/pentachlorophenol)

- ❑ Focused history and examinations such as:
  - — neurologic examination (organophosphates, carbon disulfide)
  - — psychological testing (carbon disulfide, mercury)
  - — skin examination (PCBs, dioxins)

These tests may be performed before and after site work, periodically during site work and after any specific identifiable spill where excessive exposure might have occurred.

1.2.1 Hearing Protection

A baseline audiogram will be obtained for each employee working on the site with six (6) months of initial employment. Any employee who is exposed at or above 80 decibels will have an annual audiogram performed as part of the annual occupational physical. Audiometric tests will be performed by a licensed or certified audiologist, otolaryngologist or other physician or, by a technician who is certified by the Council of Accreditation in Occupational Hearing Conservation, or who has satisfactorily demonstrated competence in administering audiometric examinations, obtaining valid audiograms, and properly using maintaining, and checking calibration and proper functioning of the audiometers being used. A technician who operates microprocessor audiometers does not need to be certified. A technician who performs audiometric tests must be responsible to an audiologist, otolaryngologist, or other physician.

If a comparison of the annual audiogram to the baseline audiogram indicates a standard threshold shift as defined in 29 CFR 1910.95(g)(10), the employee will be informed in writing within 21 days. Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, EnSafe will comply with the following procedures contained in 29 CFR 1910.95(g)(8)(ii). EnSafe will retain all employee audiometric test records with the medical surveillance records. All audiogram records will be provided, upon request, to employees, former employees, representatives designated in writing by an individual employee and authorized State and Federal regulators.

1.3 Confidentiality

Medical records will be maintained in a confidential manner so that only authorized persons will have access to the records. These will include medical staff of EnSafe or contracted medical personnel, the individual, the individual's personal physician, or the individual's designated representative. Upon request, the individual may obtain a copy of the medical file. This will be provided within fifteen (15) days of the receipt of the written request.

Information used for research, testing, statistical, or epidemiologic purposes will have all identifying data removed, including the identity of the individual. Any medical information or findings obtained which do not affect the individual's job performance will not be made available to EnSafe. This is to maintain the patient-physician confidentiality. Upon death, retirement, resignation, or other termination of services, the records will be retained by EnSafe or contracting physician.

1.4 Safety Training and Education Program

Initial and periodic instruction and training will be conducted to assure that each EnSafe employee is capable of performing his/her work in the safest possible manner. No EnSafe employee will be permitted to participate in job activities or operate equipment unless properly trained. The Health and Safety Officer is responsible for coordinating health and safety training. Site managers/site safety officers will ensure that all EnSafe workers are properly trained prior to work operations.

The list provided below is the minimum amount of instruction and training that will be required of all EnSafe employees entering a hazardous waste/spill site. Additional training will be conducted as site specific conditions dictate.

1.4.1 Initial Training

A. Safety Orientation
  1) Administration
    a) policies
    b) programs — respiratory, training, medical monitoring
    c) right-to-know

  2) Work Organization and Control
    a) work zones
    b) site operations
    c) site security and access

B. Chemical and Physical Hazards
  1) Toxicity - routes of exposure
  2) Chemical hazard classes
  3) Mechanical hazards
  4) Heat stress
  5) Fire and explosion hazards
  6) Radiation

C. Respiratory Protection
  1) Types of equipment; levels of protection
  2) TLVs; PELs; protection factors
  3) Selection
  4) Practice use (and fit-testing); maintenance
  5) Cascade system (optional)

D. Protective Clothing
  1) Types of equipment; levels of protection
  2) Permeation; breakthrough
  3) Selection
  4) Practice use; maintenance

E. Decontamination Procedures
  1) Rationale
  2) Procedures
  3) Selection

F. Ambient Monitoring
  1) Rationale
  2) Types of equipment
  3) Guidelines for exposures
  4) Practice use of equipment

G. Sampling (optional)
  1) Procedures and equipment
  2) Shipping/packaging/manifesting

H. Safety Planning and Procedures
  1) General measures
  2) Site safety considerations
  3) Selection of protective and monitoring equipment (optional)
  4) Safety Plan development (optional)

I. First Aid/CPR (at least one individual on site)

1.4.2 Annual Review Training

A. Respiratory Protection
  1) Selection
  2) Practice use (and fit-testing)

B. Protective Clothing
  1) Selection
  2) Practice Use

C. Decontamination Procedures

D. Ambient Monitoring

E. First Aid/CPR (as needed)
  1) Maintain current certification
  2) Heat stress

F. Review Specific jobs and discuss problems encountered and improvements needed.

Records will be kept of all health and safety training and copies provided to the Health and Safety Officer upon request. Audits will be conducted at least annually by the Health and Safety Officer to evaluate the program's effectiveness.

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Section 2: General Health and Safety Plan

2.1 Introduction
EnSafe anticipates that the following comprehensive safety plan is applicable to most investigative and cleanup actions involving hazardous materials. This plan is used to assign responsibilities, establish mandatory operating procedures, and provide for contingencies that may arise while operations are being conducted at hazardous waste/spill sites. A specific site safety plan will be developed and implemented based upon this general plan to address individual hazards at each site.

2.2 Applicability
The provisions of this plan and the specific site safety plan are mandatory for all of EnSafe personnel and all personnel under contract to EnSafe. Activities covered by these plans include investigation, sampling, and mitigation undertaken on-site or at any off-site areas which may be affected by contamination from the site. All visitors to the site will be required to abide by the procedures established in accordance with general and specific safety plans.

2.3 Responsibilities
Each site shall have, at a minimum, an employee of EnSafe designated as a site manager and.or site safety officer.

2.3.1 Site Manager (SM)
The SM is responsible for:
- Assuring that appropriate equipment is available and properly used by all EnSafe and contractor personnel
- Assuring that personnel are aware of the provisions of this plan and the potential hazards associated with specific site operations
- Assuring that personnel are instructed in safe work practices and in procedures for dealing with emergencies
- Supervising the monitoring of safety performances by all personnel to ensure that required work practices are employed
- Correcting any work practices or conditions that may result in injury or exposure to toxic substances

2.3.2 Site Safety Officer

The Site Safety Officer will administer the safety program at the site and will:

- Obtain and interpret instrument reading to determine the degree of hazard present
- Determine personnel protection levels necessary to ensure personnel safety
- Monitor decontamination procedures
- Evaluate weather and chemical hazard information, and recommend to the SM any modifications to work plans and protection levels necessary to ensure personnel safety
- Conduct safety briefings as appropriate
- Monitor the safety performance of all personnel to ensure that the required practices are utilized

2.3.3 Contractors to EnSafe

Contractors to EnSafe are responsible for ensuring that their personnel meet all of the requirements specified in the general and specific site safety plans. Non-qualified personnel will be excluded from the job site.

2.4 Site History and Description

A review of the existing data about the site to date will be conducted to assess the potential hazards to be encountered by EnSafe and contractor personnel. The following information will be included in the specific site safety plan:

- The type of work and activities performed at the site, if known
- The (suspected) magnitude and scope of the situation
- The results and recommendations of previous surveys
- Information about specific hazards that may be encountered

2.5 Site Organization and Control

Site organization and control will be established and maintained according to the recommendations set forth in the EPA's "interim Standard Operating Safety Guides, Revised September, 1982." Three general zones of operation will be established for each site to reduce the potential for contaminant migration and risk of personnel exposure to hazardous substances.

- Exclusion Zone
- Contamination Reduction Zone
- Support Zone

The sizes and distances between each contiguous area must be established for each cleanup or investigation site. Considerable judgment is needed to assure safe working distances for each area balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field and laboratory measurements combined with meteorological conditions are generally used in establishing and adjusting area boundaries.

2.5.1 Exclusion Zone

The Exclusion Zone constitutes the place where active cleanup and/or investigation operations take place. Since the area is considered contaminated, all personnel within the area must use the prescribed levels of personal protection equipment. A checkpoint must be established at the periphery of the Exclusion Zone to regulate the flow of personnel and equipment into and out of the area. The Exclusion Zone boundary (hotline) is established initially based upon the actual presence of wastes or spilled materials, and is placed around drums, tanks, ponds, liquid run-off, or other physical indicators of hazardous substances. The boundary may be adjusted based on subsequent observations and/or measurements. The Exclusion Zone should be physically secure and posted or well-defined by geographical and physical boundaries.

The Exclusion Zone may be subdivided into areas based on environmental measurements or expected on-site work conditions. Criteria for determining the areas are listed below.

Area A

Area A is an area where maximum respiratory, skin, and eye protection are required. An area may be designated as Area A:

- Where atmospheres have the potential to be immediately dangerous to life and health (IDLH)
- Where atmosphere sampling indicates concentrations capable of being absorbed through the skin or eyes in toxic quantities or where atmospheric concentrations of corrosives exist which could destroy skin

Area B

Area B is an area where maximum respiratory protection is required and there is low probability of dermal toxicity. An area may be designated as Area B:

- Where atmospheric concentrations of contaminants are known and they are greater than the protection factors for air purifying respirators or where the atmosphere is oxygen deficient (less than 19.5% by volume oxygen)
- When the contaminants have good warning properties
- Where the contaminants are not known to be absorbed through or be toxic to the skin
- When a reliable history of prior entry exists without acute or chronic health effects

Area C

Area C is an area where a lesser degree of respiratory protection is required than in Area A or Area B and there is low probability of dermal toxicity. An area may be designated as Area C:

- When air contaminant levels are being monitored and do not exceed the protection factors of air purifying respirators
- When the contaminants have good warning properties
- Where the contaminants are not known to be absorbed through or be toxic to the skin
- When a reliable history of prior entry exists without acute or chronic health effects

Area D

Area D is an area where the use of respiratory protective equipment is not required. An area may be designated as Area D:

- Where no known airborne hazards are present and there is little or no potential for release of hazardous airborne contaminants
- Where work operation precludes splashing of hazardous materials
- If there are no areas designated as Area A within the same Exclusion Zone

2.5.2 Contamination Reduction Zone

The Contamination Reduction Zone serves as a buffer between the Exclusion Zone and the Support Zone (see Figure 2-1), and is intended to prevent the spread of contaminants from work areas. All decontamination procedures are within this area.

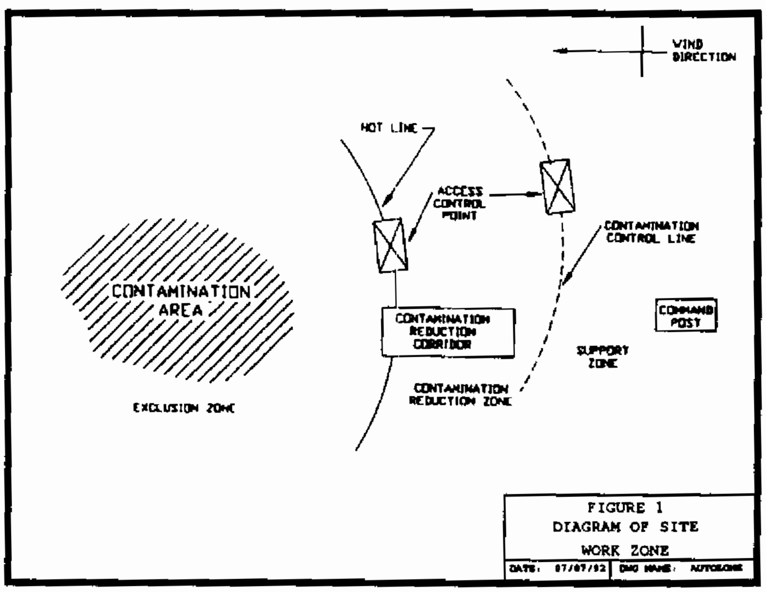

Figure 2-1: Containment Diagram

The boundary between the Support Zone and the Contamination Reduction Zone is known as the contamination control line. This boundary separates the area of possible contamination from the clean areas. Entry into the Contamination Reduction Zone from the Support Zone will be through a controlled access point. Personnel entering into this area must wear the prescribed personal protective equipment. Exit from the Contamination Reduction Zone requires the removal of any suspected or known contaminants through compliance with established decontamination procedures (See section 2.18: Decontamination).

2.5.3 Support Zone

The Support Zone is the outermost zone and is considered a noncontaminated or clean area. It contains the command post for field operations, first aid station, and other elements necessary to support site cleanup/investigation activities. Normal street clothes are worn in this area.

Location of the command post within the Support Zone is based on a number of factors:

- *Wind direction*. Preferably the command post should be located upwind of the site Exclusion Zone. However, wind direction shift and other conditions may be such that the ideal location based upon wind direction does not exist.
- *Topography*. The terrain, i.e., woods, water or hills and available space may limit selection of command post sites.
- *Site Accessibility*. Adequate roads should be available to enter and exit the site.

The use of the three-area designation with access/egress control points coupled with established decontamination procedures provides reasonable assurance against the translocation of contaminants. This system of control is based on a "worst case" situation and requires substantial numbers of personnel and equipment. Less stringent site control and decontamination procedures may be utilized when accurate information on the type of contaminants and the hazards they present are known. This information can be obtained from air monitoring, instrument survey, wipe tests and technical data concerning the characteristics of the substances present. Predicated on having more reliable data, site control requirements should be selected for each specific situation and must be approved by the SM.

2.6 Education and Training

Initial and periodic training will be conducted by the Health and Safety Officer to assure that each EnSafe employee is capable of performing his/her assigned tasks in the safest possible manner.

Training will include:

- Names of personnel and alternates responsible for safety and health
- Safety, health, and other hazards that may be present on site
- Use of all personal protective equipment including respiratory protective equipment and protective clothing;
- Work practices by which the employee can minimize risks from hazards
- Safe use of engineering controls and equipment that may be on the site
- Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards
- Site control measures
- Decontamination procedures
- Site's standard operating procedures

- A contingency plan for safe and effective responses to emergencies including the necessary personal protective equipment and other equipment
- Confined space entry procedures

Records will be kept of all training.

All on-site personnel will receive a specific site orientation before proceeding with site operations. A record of the orientation will be entered into the daily site log. The orientation must include the following:

- ❑ Health effects and hazards of the chemical and physical agents identified or suspected of being on site
- ❑ Scope of operations:
  - — Site organization
  - — Work activities
  - — Use of lunch, break and shower facilities
- ❑ Personal protective equipment to be used while on-site
- ❑ Decontamination procedures
- ❑ Emergency procedures.
- ❑ Requirements for additional medical monitoring (if applicable)

The Site Safety Officer or designated representative will conduct safety briefings at the beginning of each work shift and record the contents in the daily log. The briefings will call attention to special hazards associated with the day's activities and convey changes in work practices and/or safety practices.

2.7 Medical Surveillance

EnSafe uses a medical monitoring program administered by the Company doctor. The purpose of the program is to determine each employee's health status and fitness (including the ability to wear negative pressure respirators) to work at hazardous waste/spill sites. All EnSafe personnel are required to undergo initial periodic, exit and special examinations, as may be deemed necessary by the program administrator.

EnSafe Site Managers are required to notify the EnSafe Health and Safety Officer (who in turn will confer with the Company doctor when feasible) prior to cleanup/investigative activities, so the need for special medical monitoring can be determined and arranged.

Employee medical surveillance records are retained for the length of employment plus thirty (30) years.

Contractors to EnSafe will be required to furnish evidence of an equivalent medical monitoring program which includes all personnel entering hazardous materials cleanup and or investigation sites.

The availability of emergency care and treatment will be addressed in section 2.19: Contingency Plans.

2.8 General Measures

A primary goal of EnSafe is the prevention of all occupationally related injuries and illnesses. The following practices are presented as general precautionary measures for reducing the risks associated with hazardous waste/spill operations. Failure to adhere to the measures will result in disciplinary action.

2.8.1 Personal Hygiene

- Eating, drinking, chewing gum or tobacco, taking medication, and smoking is prohibited in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists.
- Upon leaving contaminated or suspected contaminated areas, the hands and face must be thoroughly washed. After decontamination procedures, a thorough shower and washing of the body may be required.
- Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, muds, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on the ground, drums, or equipment.
- No beard or facial hair which interferes with a satisfactory qualitative respirator fit test may be worn.

2.8.2 Personal Protection

- Be familiar with and knowledgeable about standard operating safety procedures.
- Be familiar with, knowledgeable about, and adhere to all instructions in the site safety plan.
- Identify and arrange for emergency medical assistance. The location, telephone number, and transportation capabilities of the nearest emergency medical facilities should be known. For particularly hazardous operations, the on-site medical facility should be alerted.
- Consider fatigue, heat stress, cold exposure and other environmental factors influencing the efficiency of personnel.
- Wear only NIOSH approved or designated respiratory protective devices and protective clothing.

2.8.3 Operations

- In emergencies and routine operations in respirators, oral and/or semaphore safety protocols must be established by the team consistent with the site safety plan.
- EnSafe personnel going on-site must be thoroughly briefed on the practices, emergency procedures, and communication methods.
- Initial entry team entrance and exit routes must be planned and emergency escape routes delineated.
- Unfamiliar operations must be rehearsed prior to implementation.
- Personnel on-site use the "buddy system" (pairs). "Buddies" prearrange hand signals or other means of emergency signals for communication in case of lack of radios or radio failure. At a minimum, use of self-contained breathing apparatus (SCBA) and fully-encapsulating suits require a third person, suitably equipped, as a safety person backup. Communications between these three members must be maintained at all times.
- Visual contact is maintained between "pairs" on-site with the team members remaining in close proximity in order to assist each other in case of emergencies.
- Wind indicators visible to all on-site personnel must be provided to indicate possible routes to upwind escape.
- The number of personnel and equipment in the contaminated area must be minimized consistent with site operations.
- Appropriate work areas for support, contamination reduction, and exclusion must be established.
- Appropriate decontamination procedures for leaving the site must be established.

2.9 Ambient Monitoring

Ambient monitoring will be performed at all hazardous waste cleanup/investigation sites. However, the nature and extent of the monitoring will depend on the activity being performed and the known or suspected hazard(s) present. (See Table 2-1: Ambient Monitoring Action Levels.) A protocol for monitoring will be developed for each site and included in the specific site safety plan. Generally, monitoring will be conducted for organic vapors, combustible gases, oxygen-deficient atmospheres, and radioactivity. Inorganic gases, other airborne toxic contaminants, and physical hazards will be evaluated and monitored as appropriate. A knowledgeable individual should be consulted whenever specific information is required.

2.9.1 Organic Vapors

The hNu photoionization detector and Century Organic Vapor Analyzer operating in the total organics mode are commonly used to screen the site for organic vapors. These gross measurements are used to delineate both levels of protection and different zones within the Exclusion Zone. Higher than background reading also may indicate the presence of combustible gases and be prime areas for explosivity measurements.

Table 2-1: Ambient Monitoring Action Levels

Monitoring Equipment	Hazard	Level	Action
Explosimeter	Explosive Atmosphere	• Less than 10% LEL • >10% LEL <20% LEL	Complete on-site inspection
Oxygen Meter	Oxygen Deficiency	• Less than 19.5% oxygen (by Volume) • Note the explosimeter readings are not valid in atmospheres with less than 19.5% oxygen • More than 19.5% oxygen (by Volume)	☞ • Complete inspection with SCBA with continuous monitoring ☞ • Complete inspection
Radiation Detector	Radiation (Alpha, Beta, Gamma)	• Less than 0.02 MR/hr • More than 0.02 MR/hr • More than 2.0 MR/hr	☞ • Complete inspection ☞ • Complete inspection with continuous monitoring ☞ • Radiation hazard; evacuate and consult health physicist
Draeger Tubes	Organic and Inorganic Vapors and Gases	Species dependent	Consult reference materials for toxic substances
hNu Photoionizer	Organic and Inorganic Vapors and Gases	Species dependent	Complete inspection with continuous monitoring; consult reference materials for action levels
Organic Vapor Analyzer	Organic Vapors and Gases	Species dependent	Complete inspection with continuous monitoring, consult reference materials for action levels
Combustible Gas Indicator	Explosive Atmosphere	• <10% LEL • 10%-20% LEL • >20% LEL	☞ • Continue investigation. ☞ • Continue onsite monitoring with extreme caution as higher levels are encountered. ☞ • Explosion hazard. Withdraw from area immediately.

When the identity of the contaminant is unknown, the following readings (total organic vapors) will be used to establish work zones within the Exclusion Zone and the level of personal protection:

Known Wastes - no air hazard	Area D/Level D
0-5 ppm above background	Area C/Level C
5-500 ppm above background	Area B/Level B
500-1000 ppm above background	Area A/Level A

Qualitative and quantitative determinations should be made whenever feasible. The hNu can be used to make semiqualitative determinations by employing a series of different detector probes.

Quantitative and qualitative measurements can be made with the Century analyzer when it is used in the gas chromatograph mode. However, the level of operator training and calibrations necessary often preclude use in the gas chromatograph mode.

2.9.2 Inorganic Gases

Presently, the hNu and Century analyzer have limited detection capabilities for inorganic gases. Notable ones are hydrogen cyanide (HCN) and hydrogen sulfide (H_2S). Consideration should be made for using direct reading equipment such as colorimetric tubes (Draeger or equivalent) or other direct reading instruments when there are gases suspected of being present.

2.9.3 Combustible Gases/Vapors

The presence or absence of combustible gases/vapors should be determined using an approved instrument. If explosivity reading greater than 10% of the lower explosive limit (LEL) are detected, a very careful investigation and mapping of the area must be made. Reading approaching or greater than 20% of the LEL are cause for immediate withdrawal of personnel from the on-site area. Before the resumption of any on-site activities, project personnel in consultation with personnel skilled in fire or explosion hazards must develop refined safety plans. Prime areas to monitor for the presence of combustible gases and vapors are pits and trenches where the buildup of the gases and vapors can occur. In addition, containers of materials should be inspected for leaks and the releases of combustible gases and vapors. The presence of combustible gases and vapors may also indicate the presence of toxic hazards and should be investigated.

2.9.4 Oxygen Deficiency

At least 19.5% by volume oxygen must be present in the ambient air to work without using air-supplied equipment. Oxygen deficiency measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of accidents that have produced heavier-than-air gases/vapors which could displace ambient atmospheres. The displacement of oxygen may result in atmospheres that are toxic as well as oxygen deficient. Therefore, oxygen levels should be monitored with an approved instrument upon initial entry to all sites and periodically (or continuously) where conditions such as the above are present.

2.9.5 Radiation

Although radiation monitoring is not necessary for most on-site activities, it should be incorporated in the initial survey where applicable. Normal gamma radiation background is approximately 0.01 to 0.02 milliroentgen per hour (MR/hr) on a gamma survey instrument. Radiation exposure levels should not be more that 2-3 times background levels and at no time should exposure be 10 MR/hr or above without the advice of a qualified health physicist [if such advice is needed, contact Dr. Roy Parker at (504) 924-1473]. Absence of instrument reading above background may be misinterpreted as the complete absence of radioactivity. Radioactive materials emitting low energy gamma, alpha, or beta radiation may be present, but for a number of reasons will not cause a response on the instrument. Unless airborne, these radioactive materials should present a minimal hazard to initial on-site personnel, but more thorough surveys should be conducted as site operations continue in order to completely determine the presence or absence of radioactive material.

2.10 Personal Protection Equipment (PPE)

It is important that personal protective equipment (PPE) be appropriate to protect against the potential or known hazards at each cleanup/investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the personal protective equipment required based on past experiences and sound safety practices.

The appropriate level of protection will be determined prior to the initial entry based on the best available information and be included in the site-specific safety plan. Subsequent information, i.e., sampling results and site observations, may necessitate changes in the original level selected which will be added to site-specific safety plans as changes.

The levels of personal protection were determined by the USEPA and are to be used in selecting equipment for on-site activities. The levels are designated as Level A, B, C, and D. They correspond with the work areas in the Exclusion Zone and are consistent with the levels of protection described in OSHA 1910.120, Appendix B.

2.10.1 Selection of Protective Clothing and Accessories

In this section, personal clothing is considered to be any article offering skin and/or body protection. It includes:

- Fully-encapsulating suits
- Nonencapsulating suits
- Aprons, leggings, and sleeve protectors
- Gloves
- Fire fighters' protective clothing
- Proximity, or approach, garments
- Blast and fragmentation suits
- Cooling garments
- Radiation-protective suits

Each type of protective clothing has a specific purpose; many, but not all, are designed to protect against chemical exposure. Tables 2-2 through 2-8 describe various types of protective clothing available, details the type of protection they offer, and lists the factors to consider in their selection and use.

Table 2-8 also describes a number of accessories that might be used in conjunction with a PPE ensemble, namely:

- Knife
- Flashlight or lantern
- Personal locator beacon
- Personal dosimeters
- Two-way radio
- Safety belts, harnesses, and lifelines

2.10.2 Selection of Chemical-Protective Clothing (CPC)

Chemical-protective clothing (CPC) is available in a variety of materials that offer a range of protection against different chemicals. The most appropriate clothing material will depend on the chemicals present and the task to be accomplished. Ideally, the chosen material resists permeation, degradation, and penetration. Permeation is the process by which a chemical dissolves in and/or moves through a protective clothing material on a molecular level. Degradation is the loss of or change in the fabric's chemical resistance or physical properties due to exposure to chemicals, use, or ambient conditions (e.g., sunlight). Penetration is the movement of chemicals through zippers, stitched seams, or imperfections (e.g., pinholes) in a protective clothing material.

Selection of chemical-protective clothing is a complex task and should be performed by personnel with training and experience. Under all conditions, clothing is selected by evaluating the performance characteristics of the clothing against the requirements and limitations of the site- and task-specific conditions. If possible, representative garments should be inspected before purchase and their use and performance discussed with someone who has experience with the clothing under consideration. In all cases, the employer is responsible for ensuring that the personal protective clothing (and all PPE) necessary to protect employees from injury or illness that may result from exposure to hazards at the work site is adequate and of safe design and construction for the work to be performed (see OSHA standard 29 CFR part 1910.132-1910.137).

Permeation and Degradation

The selection of chemical-protective clothing depends greatly upon the type and physical state of the contaminants. This information is determined during site characterization. Once the chemicals have been identified, available information sources should be consulted to identify materials that are resistant to permeation and degradation by the known chemicals. One excellent reference, "Guidelines for the Selection of Chemical-Protective Clothing," provides a matrix of clothing material recommendations for approximately 300 chemicals based on an evaluation of permeation and degradation data from independent tests, vendor literature, and raw material suppliers. Charts indicating the resistance of various clothing materials to permeation and degradation are also available from manufacturers and other sources. It is important to note, however, that no material protects against all chemicals and combinations of chemicals, and that no currently available material is an effective barrier to any prolonged chemical exposure.

In reviewing vendor literature, it is important to be aware that the data provided are of limited value. For example, the quality of vendor test methods is inconsistent; vendors often rely on the raw material manufacturers for data rather than conducting their own tests; and the data may not be updated. In addition, vendor data cannot address the wide variety of used and challenges to which CPC may be subjected. Most vendors strongly emphasize this point in the descriptive text that accompanies their data.

Another factor to bear in mind when selecting CPC is that the rate of permeation is a function of several factors, including clothing material type and thickness, manufacturing method the concentrations(s) of the hazardous substance(s), temperature, pressure, humidity, the solubility of the chemical in the clothing material, and the diffusion coefficient of the permeating chemical in the clothing material. Thus permeation rates and breakthrough time (the time from initial exposure until hazardous material is detectable on the inside of the CPC) may vary depending on these conditions.

Most hazardous wastes are mixtures for which specific data with which to make a good CPC selection are not available. Due to a lack of testing, only limited permeation data for multicomponent liquids are currently available.

Mixtures of chemicals can be significantly more aggressive towards CPC materials than can any single component alone. Even small amounts of a rapidly permeating chemical may provide a pathway that accelerates the permeation of other chemicals. Formal research is being conducted on these effects. NIOSH is currently developing methods for evaluating CPC materials against mixtures of chemicals and unknowns in the field. For hazardous waste site operations, CPC should be selected that offers the widest range of protection against the chemicals expected on site. Vendors are now providing CPC material—composed of two or even three different materials laminated together—that is capable of providing the best features of each material.

Heat Transfer Characteristics

The heat transfer characteristics of CPC may be an important factor in selection. Since most chemical protective clothing is virtually impermeable to moisture, evaporative cooling is limited. The "clo" value (thermal insulation value) of chemical protective clothing is a measure of the capacity of CPC to dissipate heat loss through means other than evaporation. The larger the clo value, the greater the insulating properties of the garment and, consequently, the lower the heat transfer. Given other equivalent protective properties, clothing with the lowest clo value should be selected in hot environments or for high work rates.

Unfortunately, clo values for clothing are rarely available at present.

Other Considerations
In addition to permeation, degradation, penetration, and heat transfer, several other factors must be considered during clothing selection. These affect not only chemical resistance, but also the worker's ability to perform the required task. The following checklist summarizes these considerations.

- ❑ Durability
  - — Does the material have sufficient strength to withstand the physical stress of the task(s) at hand?
  - — Will the material resist tears, punctures, and abrasions?
  - — Will the material withstand repeated use after contamination/decontamination.?

- ❑ Flexibility
  - — Will the CPC interfere with the workers' ability to perform their assigned tasks (particularly important to consider for gloves)?

- ❑ Temperature effects
  - — Will the material maintain its protective integrity and flexibility under hot and cold extremes?

- ❑ Ease of decontamination
  - — Are decontamination procedures available on site?
  - — Will the material pose any decontamination problems?
  - — Should disposable clothing be used?

- ❑ Compatibility with other equipment
  - — Does the clothing preclude the use of another, necessary piece of protective equipment (e.g., suits that preclude hard hat use in hard hat area)?

- ❑ Duration of Use
  - — Can the required task be accomplished before contaminant breakthrough occurs, or degradation of the CPC becomes significant?

Special Conditions
Fire, explosion, heat, and radiation are considered special conditions that require special-protective equipment. Unique problems are associated with radiation and it is beyond the scope of this manual to discuss them properly. A qualified health physicist should be consulted if a radiation hazard exists. Special-protective equipment is described in Tables 2-2 through 2-8: Protective Clothing and Accessories. When using special-protective equipment, it is important to also provide protection against chemicals, since the specialized equipment may provide little or no protection against chemicals which may also be present.

Table 2-2: Protective Clothing and Accessories — Full Body (Part 1 of 2)

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Fully-encapsulating suit	One-piece garment. Boots and gloves may be integral, attached and replaceable, or separate.	Protects against splashes, dust, gases, and vapors.	Does not allow body heat to escape. May contribute to heat stress in wearer, particularly if worn in conjunction with a close-circuit SCBA; a cooling garment may be needed. Impairs worker mobility, vision, and communication.
Non-encapsulating suit	Jacket, hood, pants, or bib overalls, and one-piece coveralls.	Protects against splashes, dust, and other materials but not against gases and vapors. Does not protect parts of head or neck.	• Do not use where gas-tight or pervasive splash protection is required. • May contribute to heat stress in wearer. • Tape-seal connections between pant cuffs and boots and between gloves and sleeves.
Aprons, leggings, and sleeve protectors	• Fully sleeved and gloved apron. • Separate coverings for arms and legs. • Commonly worn over non-encapsulating suit.	Provides additional splash protection of chest, forearms, and legs.	• Whenever possible, should be used over a non-encapsulating suit (instead of using a fully-encapsulating suit) to minimize potential for heat stress. • Useful for sampling, labeling, and analysis operations. Should be used only when there is a low probability of total body contact with contaminants.
Fire fighters' protective clothing	Gloves, helmet, running or bunker coat, running or bunker pants (NFPA No. 1971, 1972, 1973), and boots.	Protects against heat, hot water, and some particles. Does not protect against gases and vapors, or chemical permeation or degradation. NFPA Standard No. 1971 specifies that a garment consist of an outer shell, an inner liner, and a vapor barrier with a minimum of water penetration of 25 lbs/in^2 (1.8kg/cm^2) to prevent the passage of hot water.	• Decontamination is difficult. • Should not be worn in areas where protection against gases, vapors, chemical splashes, or permeation is required.
Proximity garment (approach suit)	• One- or two-piece overgarment with boot covers, gloves, and hood of aluminized nylon or cotton fabric. • Normally worn over other protective clothing, such as chemical-protective clothing, fire fighters' bunker gear, or flame-retardant coveralls.	• Protects against brief exposure to radiant heat. Does not protect against chemical permeation or degradation. • Can be custom manufactured to protect against some chemical contaminants.	Auxiliary cooling and a SCBA should be used if the wearer may be exposed to a toxic atmosphere or needs more than 2 or 3 minutes of protection.

Table 2-2: Protective Clothing and Accessories — Full Body (Part 2 of 2)

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Blast and fragmentation suit	Blast and fragmentation vests and clothing, bomb blankets, and bomb carriers.	Provides some protection against very small detonations. Bomb blankets and baskets can help redirect a blast.	Does not provide hearing protection.
Radiation-contamination protective suit	Various types of protective clothing designed to prevent contamination of the body by radioactive particles.	Protects against alpha and beta particles. Does NOT protect against gamma radiation.	Designed to prevent skin contamination. If radiation is detected on-site, consult an experienced radiation expert and evacuate personnel until the radiation hazard has been evaluated.
Flame/fire retardant coveralls	Normally worn as an undergarment.	Provides protection from flash fires.	Adds bulk and may exacerbate heat stress problems and impair mobility.
Flotation gear	Life jackets or work vests. (Commonly worn underneath chemical protective clothing to prevent flotation gear degradation by chemicals.)	Adds 15.5 to 25 lbs. (7 to 11.3 kg) of buoyancy to personnel working in or around water.	Adds bulk and restricts mobility. Must meet USCG standards (46 CFR Part 160).
Cooling garment	One of three methods: 1. A pump circulates cool, dry air throughout the suit or portions of it via an air line. Cooling may be enhanced by use of vortex cooler, refrigeration coils, or a heat exchanger. 2. A jacket or vest having pockets into which packets of ice are inserted. 3. A pump circulates chilled water from a water/ice reservoir and through circulating tubes, which cover part of the body (generally the upper torso only).	Removes excess heat generated by worker activity, the equipment, or the environment.	1. Pumps circulating cool air required to 20 ft³ (0.3 to 0.6m³) of respirable air per minute, so they are often uneconomical for use at a waste site. 2. Jackets or vests pose ice storage and recharge problems. 3. Pumps circulating chilled water pose ice storage problems. The pump and battery add bulk and weight.

Table 2-3: Protective Clothing and Accessories — Head

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Safety helmet (hard hat)	For example, a hard plastic or rubber helmet.	Protects the head from blows.	Helmet shall meet OSHA standard 29 CFR 1910.135.
Helmet liner		Insulates against cold. Does not protect against chemical splashes.	
Hood	Commonly worn with a helmet.	Protects against chemical splashes, particulates, and rain.	
Protective hair		• Protects against chemical contamination of hair. • Prevents the entanglement of hair in machinery or equipment. • Prevents hair from interfering with vision and with the functioning of respiratory protective devices.	Particularly important for workers with long hair.

Table 2-4: Protective Clothing and Accessories — Eyes and Face

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
covering Face Shield	Full-face coverage, eight-inch minimum.	• Protects against chemical splashes. • Does not protect adequately against projectiles.	Face shields and splash hoods must be suitably supported to prevent them from shifting and exposing portions of the face or obscuring vision. Provides limited eye protection.
Splash hood		• Protects against chemical splashes. • Does not protect adequately against projectiles.	
Safety glasses		Protects eyes against large particles and projectiles.	If lasers are used to survey a site, workers should wear special protective lenses.
Goggles		Depending on their construction, goggles can protect against vaporized chemicals, splashes, large particles, and projectiles (if constructed with impact resistant lenses).	
Sweat bands		Prevents sweat-induced eye irritation and vision impairment.	

Table 2-5: Protective Clothing and Accessories — Ears

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Ear muffs		Protects against physiological damage and psychological disturbance.	Must comply with OSHA regulation 29 CFR 1910.95. Can interfere with communication.
Headphones	Radio headset with throat microphone.	Provides some hearing protection while enabling communication.	Highly desirable, particularly if emergency conditions arise.

Table 2-6: Protective Clothing and Accessories — Hands and Arms

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Gloves and sleeves	• May be integral, attached, or separate from other protective clothing. • Disposable gloves	• Protects hands and arms from chemical contact. ☞ • Should be used whenever possible to reduce decontamination needs.	☞ Wear jacket cuffs over glove cuffs to prevent liquid from entering the glove. Tape-seal gloves to sleeves to provide additional protection.

Table 2-7: Protective Clothing and Accessories — Foot

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Safety boots	• Boots constructed of chemical-resistant material. • Boots constructed with some steel materials (e.g., toes, shanks, insoles). • Boots constructed from nonconductive, spark-resistant materials or coatings.	☞ • Protects feet from contact with chemicals. ☞ • Protects feet from compression, crushing, or puncture by falling, moving, or sharp objects. ☞ • Protects the wearer against electrical hazards and prevents ignition of combustible gases or vapors.	☞ All boots must at least meet the specifications required under OSHA 29 CFR 1910.136 and should provide good traction.
Disposable shoe or boot cover	Made of a variety of materials. Slips over the shoe or boot.	• Protects safety boots from contamination. • Protects feet from contact with chemicals.	Covers may be disposed of after use, facilitating decontamination.

Table 2-8: Protective Clothing and Accessories — General

Type of Clothing or Accessory	Description	Type of Protection	Use Considerations
Knife		Allows a person in a fully-encapsulated suit to cut his or her way out of the suit in the event of an emergency or equipment failure.	Should be carried and used with caution to avoid puncturing the suit.
Flashlight or lantern		Enhances visibility in buildings, enclosed spaces, and the dark.	• Must be intrinsically safe or explosion-proof for use in combustible atmospheres. Sealing the flashlight in a plastic bag facilitates decontamination. • Only electrical equipment approved as intrinsically safe, or approved for the class and group of hazard as defined in Article 500 of the National Electical Code, may be used.
Personal dosimeter		Measures worker exposure to ionizing radiation and to certain chemicals.	To estimate actual body exposure, the dosimeter should be placed inside the fully-encapsulating suit.
Personal locator beacon	Operated by sound, radio, or light.	Enables emergency personnel to locate victim.	
Two-way radio		Enables field workers to communicate with personnel in the Support Zone.	
Safety belts, harnesses, and lifelines		Enables personnel to work in elevated areas, enter confined areas, and prevent falls. Belts may be used to carry tools and equipment.	Must be constructed of spark-free hardware and chemical-resistant materials to provide proper protection. Must meet OSHA standards in 29 CFR 1926.104.

2.10.3 Selection of Ensembles

Level of Protection

The individual components of clothing and equipment must be assembled into a full protective ensemble that both protects the worker from the site-specific hazards and minimizes the hazards and drawbacks of the PPE ensemble itself.

Tables 2-9 through 2-11: Sample Protective Ensembles lists ensemble components based on the widely used EPA Levels of Protection: Levels A, B, C, and D. These lists can be used as a starting point for ensemble creation; however, each ensemble must be tailored to the specific situation in order to provide the most appropriate level of protection. For example, if work is being conducted at a highly contaminated site or if the potential for contamination is high, it may be advisable to wear a disposable covering, such as Tyvek coveralls or PVC splash suits, over the protective ensemble. It may be necessary to slit the back of these disposable suits to fit around the bulge of an encapsulating suit and SCBA.

The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the site increases, and as workers are required to perform different tasks. Personnel should be able to upgrade or downgrade their level of protection with concurrence of the Site Safety Officer and approval of the Field Team Leader.

- ❑ Reasons to upgrade
  - — Known or suspected presence of dermal hazards
  - — Occurrence or likely occurrence of gas or vapor emission
  - — Change in work task that will increase contact or potential contact with hazardous materials
  - — Request of the individual performing the task

- ❑ Reasons to downgrade
  - — New information indicating that the situation is less hazardous than was originally thought
  - — Change in site conditions that decreases the hazard
  - — Change in work task that will reduce contact with hazardous materials

Table 2-9: Sample Protective Ensembles — Level A

Equipment	Protection Provided	Should be Used When	Limiting Criteria
RECOMMENDED: • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Fully-encapsulating, chemical-resistant suit • Inner chemical-resistant gloves • Chemical-resistant safety boots/ shoes • Two-way ratio communications OPTIONAL: • Cooling unit • Coveralls • Long cotton underwear • Hard hat • Disposable gloves and boot covers	The highest available level of respiratory, skin, and eye protection.	• The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: – measured (or potential for) high concentration of atmospheric vapors, gases, or particulates *or* – site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin • Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible • Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined.	Fully-encapsulating suit material must be compatible with the substances involved.

Table 2-10: Sample Protective Ensembles — Level B

Equipment	Protection Provided	Should be Used When	Limiting Criteria
RECOMMENDED: • Pressure-demand, full facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one-or two-piece chemical-resistant one- piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/ shoes • Hard hat • Two-way radio communications OPTIONAL: • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	• The same level of respiratory protec-tion but less skinprotec-tion than Level A. • It is the minimum level recommended for initial site entries until the hazards have been further identified.	• The type and atmospheric concentrations of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: – with IDLH concentrations of specific substances that do not represent a severe skin hazard: *or* – that do not meet the criteria for use of air purifying respirators. • Atmosphere contains less than 19.5% oxygen • Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin	• Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin • Use only when it is highly unlikely that the work being done will generate either high concentration of vapors, gases, or particulates or splashes of material that will affect exposed skin.

Table 2-11: Sample Protective Ensembles — Level C

Equipment	Protection Provided	Should be Used When	Limiting Criteria
RECOMMENDED: • Full facepiece, air purifying, canister-equipped respirator • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit) • Inner and outer chemical-resistant gloves • Chemical-resistant safety boots/ shoes • Hard hat • Two-way radio communications OPTIONAL: • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear	The same level of skin protection as Level B, but a lower level ofrespi-ratory protection.	• The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. • All criteria for the use of air-purifying respirators are met.	• Atmospheric concentration of chemicals must not exceed IDLH levels. • The atmosphere must contain at least 19.5% oxygen.

2.11 PPE Use

PPE can offer a high degree of protection only if used properly. This section covers the following aspects of PPE use:

- Training
- Work Mission duration
- Personal use factors
- Fit testing
- Donning
- In-use monitoring
- Doffing
- Inspection
- Storage
- Maintenance

Decontamination is covered in section 2.18. Inadequate attention to any of these areas could compromise the protection provided by the PPE.

2.11.1 Training

Training in PPE use is recommended and, for respirators, required by federal regulation in the OSHA standards in 29 CFR Part 1910. This training:

- Allows the user to become familiar with the equipment in a nonhazardous situation
- Instills confidence of the user in his/her equipment
- Makes the user aware of the limitations and capabilities of the equipment
- Increases the efficiency of operations performed by workers wearing PPE
- Reduces the expense of PPE maintenance

Training should be completed prior to actual PPE use in a hazardous environment and should be repeated at least annually. At a minimum, the training portion of the PPE program should delineate the user's responsibilities and explain the following, utilizing both classroom and field training when necessary:

- OSHA requirements as delineated in 29 CFR Part 1910
- The proper use and maintenance of the selected PPE, including capabilities and limitations
- The nature of the hazards and the consequences of not using the PPE
- The human factors influencing PPE performance
- Instruction in inspecting, donning, checking, fitting, and using PPE
- Individualized respirator fit testing to ensure proper fit
- Use of PPE in normal air for a long familiarity period and wearing PPE in a test atmosphere to evaluate its effectiveness
- The user's responsibility (if any) for decontamination, cleaning, maintenance, and repair of PPE

- Emergency procedures and self-rescue in the event of PPE failure.
- The buddy system (see section 2.8.3: General Measures: Operations)
- The Site Safety Plan and the individual's responsibility and duties in an emergency

The discomfort and inconvenience of wearing PPE can create a resistance to the conscientious use of PPE. One essential aspect of training is to make the user aware of the need for PPE and to instill motivation for the proper use and maintenance of PPE.

2.11.2 Work Mission Duration

Before the workers actually begin work in their PPE ensembles, the anticipated duration of the work mission should be established. Several factors limit mission length. These include:

- Air supply consumption
- Suit/ensemble permeation and penetration by chemical contaminants
- Ambient temperature
- Coolant supply

Air Supply Consumption

The duration of the air supply must be considered before planning any SCBA-assisted work activity. The anticipated operating time of an SCBA is clearly indicated on the breathing apparatus. This designated operating time is based on a moderate work rate, e.g., some lifting, carrying, and/or heavy equipment operation. In actual operation, however, several factors can reduce the rated operating time. When planning an SCBA-assisted work mission, the following variables should be considered and work actions and operating time adjusted accordingly:

- *Work rate.* The actual in-use duration of SCBAs may be reduced by one-third to one-half during strenuous work, e.g., drum handling, major lifting, or any task requiring repetitive speed of motion.
- *Fitness.* Well-conditioned individuals generally utilize oxygen more efficiently and can extract more oxygen from a given volume of air (particularly when performing strenuous tasks) than unfit individuals, thereby slightly increasing the SCBA operating time.
- *Body size.* Larger individuals generally consume air at a higher rate than smaller individuals, thereby decreasing the SCBA operating time.
- *Breathing patterns.* Quick, shallow or irregular breaths use air more rapidly than deep, regularly spaced breaths. Heat-induced anxiety and lack of acclimatization (see Appendix D: Temperature Exposure Guidelines in this manual) may induce hyperventilation, resulting in decreased SCBA operating time.

Suit/Ensemble Permeation and Penetration
The possibility of chemical permeation or penetration of CPC ensembles during the work mission is always a matter of concern and may limit mission duration. Possible causes of ensemble penetration are:

- Suit valve leakage, particularly under excessively hot or cold temperatures
- Suit fastener leakage if the suit is not properly maintained or if the fasteners become brittle at cold temperatures
- Exhalation valve leakage at excessively hot or cold temperatures

Also, when considering mission duration, it should be remembered that no single clothing material is an effective barrier to all chemicals or all combinations of chemicals, and no material is an effective barrier to prolonged chemical exposure.

Ambient Temperature
The ambient temperature has a major influence on work mission duration as it affects both the worker and the protective integrity of the ensemble. Heat stress, which can occur even in relatively moderate temperatures, is the greatest immediate danger to an ensemble-encapsulated worker. Methods to monitor for and prevent heat stress are discussed later in this manual in Appendix D: Temperature Exposure Guidelines.

Hot and cold ambient temperatures also affect:

- Valve operation on suit and/or respirators
- The durability and flexibility of suit materials
- The integrity of suit fasteners
- The breakthrough time and permeation rates of chemicals
- The concentration of airborne contaminants

All these factors may decrease the duration of protection provided by a given piece of clothing or respiratory equipment.

Coolant Supply
Under warm or strenuous work conditions, adequate coolant (ice or chilled air, see Table 2-2) should be provided to keep the wearer's body at a comfortable temperature and to reduce the potential for heat stress. If coolant is necessary, the duration of the coolant supply will directly affect mission duration.

2.12 Personal Use Factors

As described below, certain personal features of workers may jeopardize safety during equipment use. Prohibitive or precautionary measures should be taken as necessary.

Facial hair and long hair interfere with respirator fit and wearer vision. Any facial hair that passes between the face and the sealing surface of the respirator should be prohibited. Even a few day's growth of facial hair will allow excessive contaminant penetration. Long hair must be effectively contained within protective hair coverings.

Eyeglasses with conventional temple pieces (earpiece bars) will interfere with the respirator-to-face seal of a full facepiece. A spectacle kit should be installed in the face masks of workers requiring vision correction.

When a worker must wear corrective lenses as part of the facepiece, the lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal. Contact lenses may trap contaminants and/or particulates between the lens and the eye, causing irritation, damage, absorption, and an urge to remove the respirator. Wearing contact lenses with a respirator in a contaminated atmosphere is prohibited (29 CFR Part 1910.134 [e][5][ii]).

Gum and tobacco chewing should be prohibited during respirator use since they may cause ingestion of contaminants and may compromise the respirator fit.

2.12.1 Donning an Ensemble

A routine should be established and practiced periodically for donning a fully-encapsulating suit/ SCBA ensemble. Assistance should be provided for donning and doffing since these operations are difficult to perform alone, and solo efforts may increase the possibility of suit damage.

Table 2-12 lists ensemble procedures for donning a fully-encapsulating suit/SCBA ensemble. These procedures should be modified depending on the particular type of suit and/or when extra gloves and/ or boots are used. These procedures assume that the wearer has previous training in SCBA use and once the equipment has been donned, its fit should be evaluated. If the clothing is too small, it will restrict movement, thereby increasing the likelihood of tearing the suit material and accelerating worker fatigue. If the clothing is too large, the possibility of snagging the material is increased, and the dexterity and coordination of the worker may be compromised. In either case, the worker should be recalled and better fitting clothing provided.

Respirator Fit Testing

The "fit" or integrity of the facepiece-to-face seal of a respirator affects its performance. A secure fit is important with positive-pressure equipment, and is essential to the safe functioning of negative-

Table 2-12: Ensemble Donning Procedures

Note:

- Perform the procedures in the order indicated.
- When donning a suit, use a moderate amount of a powder to prevent chafing and to increase comfort. Powder will also reduce rubber binding.

Steps:

1. Inspect the clothing and respiratory equipment before donning (see inspection).
2. Adjust hard hat or headpiece, if worn, to fit user's head.
3. Open back closure used to change air tank (if suit has one) before donning suit.
4. Standing or sitting, step into the legs of the suit; ensure proper placement of the feet within the suit; then gather the suit around the waist.
5. Put on chemical-resistant safety boots over the feet of the suit. Tape the leg cuff over the tops of the boots.
6. If additional chemical-resistant boots are required, put these on now. Some one-piece suits have heavy-soled protective feet. With these suits, wear short, chemical-resistant safety boots inside the suit.
7. Put on air tanks and harness assembly of the SCBA. Don the facepiece and adjust it to be secure, but comfortable. Do NOT connect the breathing hose. Open valve on air tank.
8. Perform negative and positive respirator facepiece seal test procedures. To conduct a negative-pressure test, close the inlet part with the palm of the hand or squeeze the breathing tube so it does not pass air, and gently inhale for about 10 seconds. Any inward rushing of air indicates a poor fit. Note that a leaking facepiece may be drawn tightly to the face to form a good seal, giving a false indication of adequate fit.

   To conduct a positive-pressure test, gently exhale while covering the exhalation valve to ensure that a positive pressure can be built up. Failure to build a positive pressure indicates a poor fit.

Depending on type of suit, follow these steps:

1. Put on long-sleeved inner gloves (similar to surgical gloves) Secure gloves to sleeves for suits with detachable gloves (if not done before entering the suit). Additional over gloves, worn over attached suit gloves, may be donned later.
2. Put sleeves of suit over arms as assistant pulls suit up and over the SCBA. Have assistant adjust suit around SCBA and shoulders to ensure unrestricted motion.
3. Put on hard hat, if needed.
4. Raise hood over head carefully so as not to disrupt face seal of SCBA mask. Adjust hood to give satisfactory comfort.
5. Begin to secure the suit by closing all fasteners until there is only adequate room to connect the breathing hose. Secure all belts and/or adjustable leg, head, and waistbands.
6. Connect the breathing hose while opening the main valve.
7. Have assistant first ensure that wearer is breathing properly and then make final closure of the suit.
8. Have assistant check all closures.
9. Have assistant observe the wearer for a period of time to ensure that the wearer is comfortable, psychologically stable, and that the equipment is functioning properly.

pressure equipment, such as most air-purifying respirators. Most facepieces fit only a certain percentage of the population; thus each facepiece must be tested on the potential wearer in order to ensure a tight seal. Facial features such as scars, hollow temples, very prominent cheekbones, deep skin creases, dentures or missing teeth, and the chewing of gum and tobacco may interfere with the respirator-to-face seal. A respirator shall not be worn when such conditions prevent a good seal. The worker's diligence in observing these factors shall be evaluated by periodic checks.

For a qualitative respirator fit testing protocol, see Appendix D of the OSHA lead standard (29 CFR Part 1910.1025). For quantitative fit testing, see the NIOSH publication "A Guide to Industrial Respiratory Protection." For specific quantitative testing protocols, literature supplied by manufacturers of quantitative fit test equipment should be consulted. Note that certain OSHA standards require quantitative fit testing under specific circumstances (e.g., 29 CFR Parts 1910.1018 [h] [3] [iii], 1910.1025 [f] [3] [iii], and 1910.1045 [h] [3] [iii] [B]).

2.12.2 In-Use Monitoring

The wearer must understand all aspects of the clothing operation and its limitations; this is especially important for fully-encapsulating ensembles where misuse could potentially result in suffocation.

During equipment use, workers should be encouraged to report any perceived problems or difficulties to their supervisor(s). These malfunctions include, but are not limited to:

- Degradation of the protective ensemble
- Perception of odors
- Skin irritation.
- Unusual residues on PPE
- Discomfort
- Resistance to breathing
- Fatigue due to respirator use
- Interference with vision or communication
- Restriction of movement
- Personal responses such as rapid pulse, nausea, and chest pain

If a supplied-air respirator is being used, all hazards that might endanger the integrity of the air line should be removed from the working area prior to use. During use, air lines should be kept as short as possible and other workers and vehicles should be excluded from the area.

2.12.3 Doffing an Ensemble

Exact procedures for removing fully-encapsulating suit/SCBA ensembles must be established and followed in order to prevent contaminant migration from the work area and transfer of contaminants to the wearer's body, the doffing assistant, and others.

Ensemble doffing procedures are provided in Table 2-13. These procedures should be performed only after decontamination of the suited worker. They require a suitably attired assistant. Throughout the procedures, both worker and assistant should avoid any direct contact with the outside surface of the suit.

Table 2-13: Ensemble Doffing Procedures

Note:
The sample doffing procedures listed below should be performed only after decontamination of the suited worker. They require a suitably attired assistant. Throughout the procedures, both worker and assistant should avoid any direct contact with the outside surface of the suit.

Steps if sufficient air supply is available to allow appropriate decontamination before removal:

1. Remove any extraneous or disposable clothing, boot covers, outer gloves, and tape.
2. Have assistant loosen and remove the wearer's safety shoes or boots.
3. Have assistant open the suit completely and lift the hood over the head of the wearer and rest it on top of the SCBA tank.
4. Remove arms, one at a time, from suit. Once arms are free, have assistant lift the suit up and away from the SCBA backpack—avoiding any contact between the outside surface of the suit and the wearer's body—and lay the suit out flat behind the wearer. Leave internal gloves on, if any.
5. Sitting, if possible, remove both legs from the suit. Follow manufacturer's recommended procedure for doffing SCBA.
6. After suit is removed, remove internal gloves by rolling them off the hand, inside out.
7. Remove internal clothing and thoroughly cleanse the body.

Steps if the low-pressure warning alarm has sounded, signifying that about five minutes of air remain:

1. Remove disposable clothing.
2. Quickly scrub and hose off, especially around the entrance/exit zipper.
3. Open the zipper enough to allow access to the regulator and breathing hose.
4. Immediately attach an appropriate canister to the breathing hose (the type and fittings should be predetermined). Although this provides some protection against any contamination still present, it voids the certification of the unit.
5. Follow the steps of the regular doffing procedures above. Take extra care to avoid contaminating the assistant and wearer.

2.12.4 Clothing Reuse

Chemicals that have begun to permeate clothing during use may not be removed during decontamination and may continue to diffuse through the material towards the inside surface, presenting the hazard of direct skin contact to the next person who used the clothing.

Where such potential hazards may develop, clothing should be checked inside and out for discoloration or other evidence of contamination. This is particularly important for fully-encapsulating suits, which are generally subject to reuse due to their cost. Note, however, that negative (i.e., no chemical found) test results do not necessarily preclude the possibility that some absorbed chemical will reach the suit's interior.

At present, little documentation exists regarding clothing reuse. Reuse decisions must consider the known factors of permeation rates as well as the toxicity of the contaminant(s). In fact, unless extreme care is taken to ensure that clothing is properly decontaminated and that the decontamination does not degrade the material, the reuse of chemical protective clothing that has been contaminated with toxic chemicals is not advisable.

2.12.5 Inspection

An effective PPE inspection program will probably feature five different inspections:

- Inspection and operational testing of equipment received from the factory or distributor
- Inspection of equipment as it is issued to workers
- Inspection after use or training and prior to maintenance
- Periodic inspection of stored equipment
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise

Each inspection will cover somewhat different areas in varying degrees of depth. Detailed inspection procedures, where appropriate, are usually available from the manufacturer. The inspection checklists provided in Table 2-14 may also be an aid.

Records must be kept of all inspection procedures. Individual identification numbers should be assigned to all reusable pieces of equipment (respirators may already have ID numbers) and records should be maintained by that number. At a minimum, each inspection should record the ID number, date, inspector, and any unusual conditions or findings. Periodic review of these records may indicate an item or type of item with excessive maintenance costs or a particularly high level of "down-time."

2.12.6 Storage

Clothing and respirators must be stored properly to prevent damage or malfunction due to exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact. Procedures must be specified for both pre-issuance warehousing and, more importantly, post-issuance (in-use) storage. Many equipment failures can be directly attributed to improper storage.

Clothing

- Potentially contaminated clothing should be stored in an area separate from street clothing.
- Potentially contaminated clothing should be stored in a well-ventilated area, with good air flow around each item, if possible.

Table 2-14: PPE Maintenance Checklist

Category	Before and During Use	During and After Use
Clothes	❑ Make sure that the clothes are correct for the task. ❑ Visually check for imperfect seams, tears, nonuniform coatings, malfunctioning closures. ❑ Hold up to light and check for pinholes. ❑ Flex product, check for cracks, other signs of deterioration. ❑ If used, check inside and out for signs of chemical attack: discoloration, swelling, stiffness and/or softening.	❑ During use: periodically check for evidence of chemical attack such as discoloration, swelling, stiffness and/or softening. Keep in mind that chemical permeation can occur with visible effects. ❑ Also check for: closure failure, tears, punctures, seam discontinuities.
Gloves	❑ Pressurize glove to check for pinholes: Either blow into glove, then roll gauntlet towards fingers or inflate glove and hold under water. In either case, no air should escape.	
Fully encapsulating suits	❑ Check the operation of pressure relief valves. ❑ Check the fitting of wrists, ankles and neck ❑ Check the faceshield (if equipped with one) for: cracks, crazing, fogginess.	
Self-contained breathing apparatus	❑ Check before and after use, at least monthly when in storage, and each time cleaned. ❑ Check connections for tightness. ❑ Check material for signs of pliability, deterioration, distortion. ❑ Check for proper setting and operation of regulators and valves. ❑ Check operation of alarms. ❑ Check faceshields and lenses for cracks, crazing, fogginess.	❑ After use, store SCBAs in storage chests supplied by manufacturer.
Supplied-air respirators	❑ Inspect daily when in use, at least monthly when in storage, and every time cleaned. ❑ Inspect air before each use for cracks, kinks, cuts, frays and weak areas. ❑ Check for proper setting and operation of regulators and valves. ❑ Check connections for tightness. ❑ Check material for pliability, deterioration, distortion. ❑ Check faceshields and lenses for cracks, crazing, fogginess.	❑ Inspect at least monthly when in storage using the same criteria as listed under: Before and During Use
Air-purifying respirators	❑ Inspect before use to be sure they have been adequately cleaned, after each use, during cleaning, monthly if in storage. ❑ Check material for pliability, deterioration, distortion. ❑ Check cartridges or canisters to make sure: They are the proper type for the intended use, the expiration date has not passed, and they have not been opened or used previously. ❑ Check faceshield and lenses for cracks, crazing, fogginess.	❑ Each air purifying respirator should be stored in its original carton or carrying case or in heat sealed or resealable plastic bag. ❑ Each respirator should be stored individually.

- Different types and materials of clothing and gloves should be stored separately to prevent issuing the wrong material by mistake.
- Protective clothing should be folded or hung in accordance with manufacturer's recommendations.

Respirators
SCBAs, supplied-air respirators, and air-purifying respirators should be dismantled, washed, and disinfected after each use.

2.12.7 Maintenance

The technical depth of maintenance procedures vary. Manufacturers frequently restrict the sale of certain PPE parts to individuals or groups who are specially trained, equipped, and "authorized" by the manufacturer to purchase them. Explicit procedures should be adopted to ensure that the appropriate level of maintenance is performed only by individuals having this specialized training and equipment. The following classification scheme is often used to divide maintenance into three levels:

Level 1: User or wearer maintenance, requiring a few common tools or no tools at all
Level 2: Shop maintenance that can be performed by the employer's maintenance shop
Level 3: Specialized maintenance that can be performed only by the factory or an authorized repair person

2.13 Level A (required in Area A of Exclusion Zone)

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is required. Level A protection will be required in Area A of the Exclusion Zone.

2.13.1 Level A Equipment

- ❑ Positive pressure-demand, full facepiece self-contained breathing apparatus (SCBA), or positive pressure-demand supplied air respirator with escape SCBA
- ❑ Fully-encapsulating chemical protective suit
- ❑ Outer and inner gloves (both chemical-resistant)
- ❑ Steel toe and shank, chemical resistant boots
- ❑ Hard hat (under suit)
- ❑ Two-way radios (worn inside encapsulating suit)
- ❑ Options as required:
  - — Coveralls
  - — Long cotton underwear
  - — Disposable protective suit, gloves and boots, worn over fully-encapsulating suit

2.13.2 Criteria for Use of Level A

- ❑ Atmospheres which are "immediately dangerous to life and health" (IDLH). IDLHs can be found in the NIOSH/OSHA "Pocket Guide to Chemical Hazards" and/or other references.
- ❑ Known atmospheres or potential situations that would affect the skin or eyes, or could be absorbed into the body through these surfaces. Standard reference books should be consulted to obtain concentrations hazardous to skin, eyes, or mucous membranes.
- ❑ Potential situations are those where immersion may occur, where vapors may be generated, or where splash may occur through site activities.

- ❑ Oxygen deficient atmospheres with the above conditions
- ❑ When the type(s) and/or potential concentration(s) of toxic substances are unknown

2.13.3 Contraindications for Use of Level A

- ❑ Environmental measurements contiguous to the site indicate that air contaminants present do not represent a serious dermal hazard
- ❑ Reliable, accurate historical data do not indicate the presence of severe dermal hazards
- ❑ Open, unconfined areas
- ❑ There is a minimal probability of vapors or liquids (splash hazards) present which could affect, or be absorbed through, the skin
- ❑ Total vapor readings indicate 500 ppm to 1,000 ppm

2.14 Level B

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body (i.e., neck and back of head) is unlikely, or where concentrations are known to be within acceptable standards. Level B protection will be required in Area B of the Exclusion Zone.

2.14.1 Level B Equipment

- ❑ Positive pressure-demand, full facepiece self-contained breathing apparatus (SCBA), or positive pressure-demand supplied air respirator with escape SCBA
- ❑ Hooded chemical-resistant clothing (overalls and long sleeved jacket; coveralls; one- or two-piece chemical splash suit; disposable chemical resistant overalls)
- ❑ Outer and inner gloves (both chemical-resistant)
- ❑ Steel toe and shank, chemical-resistant boots (optional)
- ❑ Hard hat (optional)
- ❑ Two-way radios (worn inside encapsulating suit)
- ❑ Options as required:
  - — Coveralls
  - — Disposable outer boots (chemical-resistant)
  - — Face shield

2.14.2 Criteria for Use of Level B

- ❑ Atmospheres with concentrations of known substances greater than protection factors associated with full face-piece, air-purifying respirators with appropriate cartridges
- ❑ Atmospheres with less than 19.5% oxygen

- ❑ Type(s) and concentration(s) of vapors in air do not present a cutaneous or percutaneous hazard to the small, unprotected areas of the body
- ❑ A determination is made that potential exposure to the body parts not protected by a fully-encapsulating suit (primarily necks, ears, etc.) is highly unlikely
- ❑ Known absence of cutaneous or percutaneous hazards or others
- ❑ Activities performed preclude splashing of individuals
- ❑ Total vapor levels range from 5 - 500 ppm on instruments such as OVA, hNu and do not contain high levels of toxic substances affecting skin or eyes
- ❑ Level B protection is recommended as the lowest level of protection for initial entries until the hazards have been further identified and defined by monitoring, sampling, and other reliable methods of analysis

2.15 Level C

Level C protection will be selected when the types and concentrations of respirable material is known, or reasonably assumed to be not greater than the protection factors associated with air-purifying respirators; and exposure to the unprotected areas of the body is unlikely to cause harm. Level C protection will be required in Area C of the Exclusion Zone.

2.15.1 Level C Equipment

- ❑ Full facepiece, air-purifying, canister-equipped respirator with appropriate chemical cartridge (a half facepiece respirator may be used in certain circumstances)
- ❑ Hooded chemical-resistant clothing (overalls; two-piece chemical splash suit; disposable chemical-resistant overalls)
- ❑ Chemical-resistant gloves (outer)
- ❑ Chemical-resistant gloves (inner)
- ❑ Hard hat (optional)
- ❑ Options as required:
  - — Coveralls
  - — Steel toe and shank, chemical-resistant boots (outer)
  - — Disposal chemical-resistant outer boots
  - — Escape mask
  - — Face shield
  - — Two-way radios (worn under outside protective clothing)

2.15.2 Criteria for Use of Level C

- ❑ When Level A or Level B is not indicated (atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin)
- ❑ The types of air contaminants have been identified, concentrations measured, and a canister respirator is available that can remove the contaminants
- ❑ All criteria for use of air-purifying respirators are met

2.16 Level D

Level D will be selected when measurements of atmospheric concentrations are at background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals. Level D will be used only in Area D portions of the Exclusion Zone.

2.16.1 Level D Equipment

- ❑ Coveralls
- ❑ Leather or chemical-resistant boots or shoes, steel toe and shank (optional)
- ❑ Hard hat (optional)
- ❑ Options as required
  - — Gloves
  - — Disposable chemical-resistant outer boots
  - — Safety glasses or chemical splash goggles
  - — Escape mask
  - — Face shield

2.17 Safety Equipment

All site personnel must be adequately protected from potential health and safety hazards. Therefore, a sufficient and diverse inventory of all safety equipment necessary to meet anticipated hazards will be available to all employees. Personnel and site visitors must be instructed in the proper use of this equipment before entry to the work area is permitted. A list of all safety equipment available at the site will be maintained and incorporated into the specific site safety plan. The list will include first aid, fire-fighting, communications, respiratory protection, protective clothing (suits, gloves, boots, hard hats, goggles, etc.) and monitoring equipment.

2.18 Decontamination

As a part of the system to prevent or reduce the physical transfer of contaminants by people or equipment from on-site areas, provisions must be made for decontaminating anything exiting the Exclusion and Contamination Reduction Zones. The extent of the decontamination procedures for personnel is highly site-specific and depends upon a number of factors: type of contaminants, amounts of contamination, level of protection, work activities, and reason for leaving the site. The USEPA has developed contamination procedures for various levels of protection which can be consulted when formulating site-specific decontamination protocols. The procedures are included as Appendix D to the NIOSH/OSHA USCG/EPA "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities".

All equipment leaving the Exclusion Zone should be decontaminated to prevent the off-site migration of hazardous contaminants. In addition, all equipment used at the site should be decontaminated upon completion of the project. For limiting potential environmental exposures, the following procedures should be used: (1) All contaminated surfaces will be rinsed with proper decontamination solution. Selection of these solutions will be made by the Site Safety Officer (see Table 2-15). (2) All decontamination activities will be supervised by the Site Safety Officer. (3) All wastewater generated will be collected and disposed of as hazardous waste.

Table 2-15: Types of Decontamination Solutions (Note: This list is not all inclusive.)

DECON SOLUTION A	-	A solution containing 5% sodium carbonate [Na_2CO_3] and 5% trisodium phosphate [Na_3PO_4].
DECON SOLUTION B	-	A solution containing 10% calcium hypochlorite [$Ca(ClO)_2$].
DECON SOLUTION C	-	A solution containing 5% trisodium phosphate [Na_3PO_4]. This solution can also be used as a general purpose rinse.
DECON SOLUTION D	-	A dilute solution of hydrochloric acid (HCl).
DECON SOLUTION E	-	A dilute solution of phosphate free analytical quality detergent.

Type of Hazard	Solution	Preparation
1. Inorganic acids, metal processing wastes	A	To 10 gallons of water, add 4 pounds of sodium carbonate (soda lime) and 4 pounds of trisodium phosphate. Stir until evenly mixed.
2. Heavy metals	A	Same as #1 above.
3. Pesticides, fungicides, chlorinated phenols, dioxins, and PCBs	B	To 10 gallons of water, add 8 gallons of calcium hypochlorite. Stir with wooden or plastic stirrer until evenly mixed.
4. Cyanides, ammonia	B	Same as #3 above.
5. Solvents and organic compounds such as trichloroethylene, chloroform, and toluene	C (or A)	To 10 gallons of water, add 8 gallons of trisodium phosphate. Stir until evenly mixed.
6. PBBs and PCBs		Same as #5 above.

2.19 Contingency Plans

The site-safety plan must address emergency medical care and treatment of all personnel, including possible exposures to toxic substances and injuries due to accidents or physical problems. The following items will be included in the emergency care provision:

- ❑ Name, address, and telephone number of the nearest medical treatment facility should be in the site safety plan and ***posted in a conspicuous location***. A map and/or directions for locating the facility, plus travel time, should be included.
- ❑ The facility's ability to provide care and treatment of personnel exposed to toxic or other hazardous substances should be ascertained. If the facility lacks toxicological capability, EnSafe's Safety and Health Officer should be consulted.
- ❑ All administrative arrangements for accepting patients will be made in advance with the facility.
- ❑ Arrangements will be made to obtain ambulance, emergency, fire, and police services. Telephone numbers and procedures for obtaining these services would be readily available.
- ❑ Emergency showers, eye wash fountains, and first aid equipment will be readily available on-site. Personnel qualified in first aid and CPR will be available.
- ❑ Provisions for providing medical personnel with information involving the nature and extent of the accident or injury will be made.

An evaluation for the possibility of events leading to evacuation of the site and surrounding community will be performed and protocols included in the site safety plan as appropriate.

2.20 Recordkeeping

A log book will be maintained by designated site personnel and serve as a record of site safety operations. At the minimum the log will include:

- ambient survey baseline readings
- ambient perimeter readings
- work site ambient readings
- variances and actions taken
- level of protection and changes used on site
- daily log of personnel in protective clothing
- injuries, prognosis, treatment and disposition
- visitors on site, and the level of protection used

2.21 Site-Specific Safety Plan

A Site-Specific Safety Plan will be developed and implemented for each site. The Plan will be based on the General Safety Plan and the information provided from the Safety Plan Work Sheet (see Appendix A). The plan will contain the following sections:

- Ambulance service
- Nearest poison control center
- EnSafe's Memphis Office

As an attachment to the health and safety plan, the name, emergency room telephone number and directions to:

- the nearest hospital
- the nearest hospital that is capable of handling a chemical exposure

In addition to the above information, this section will include the location for the nearest telephone, water supply and restroom facility. The section will also include a section on emergency procedures.

2.22 Forms

This section will list all forms associated with the health and safety plan such as:

- Plan Acceptance Form (all site employees must sign this form indicating that they have read and understand the Site Health and Safety Plan).
- Plan Feedback Form
- Accident Report Form
- Exposure History Form

Section 3: Site-Specific Safety Plan

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Section 3: Site-Specific Safety Plan

A Site-Specific Safety Plan will be developed and implemented for each site. The Plan will be based on the General Safety Plan and the information provided from the Safety Plan Work Sheet (see Appendix A). The plan will contain the following sections:

3.1 Introduction

The introduction will give the location of the site and a brief description of the contamination.

3.2 Applicability

This section is intended to clearly indicate who must follow the provisions of the Plan.

3.3 Work Zone Characterization

A site control program for preventing contamination of employees will be developed. The site control program will, as a minimum include: a description of how the site will be identified, a personnel control system, a site map, and site work zones.

3.4 Site Activities

A brief description of the activities to be performed on this site will be included in this section. These activities should summarize the activities found in the Work Plan.

3.5 Hazard Evaluation

A preliminary evaluation of a site's characteristics will be performed prior to entry by entry personnel. The site's specific characteristics will be identified along with existing site hazards and will aid in the selection of engineering controls and personal protective equipment. All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH) or other conditions that may cause death or serious harm will be identified in the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to, confined space entry, potentially explosive or flammable situations, visible vapor clouds, or areas where biological indicators such as dead animals or vegetation are located.

3.6 Employee Protection

As a minimum, this section will include the Standard Safe Work Practices; requirements for Personal Protective Equipment (PPE), including criteria for increasing the level of PPE required; procedures and equipment for extreme weather conditions, work limitations, and exposure evaluation.

3.7 Monitoring Requirements

This section will specify which type monitoring will be used for each hazard on the site. Appropriate test equipment will be used to monitor for such conditions as IDLH concentrations of substances, flammable or explosive atmospheres, oxygen deficiency, or toxic substances. Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances will be identified. Employees who will be working on the site will be informed of any risks that have been identified.

3.8 Decontamination

A decontamination procedure will be developed for each site and communicated to all site employees and implemented before any employees or equipment enter work areas on the site where potential for exposure to hazardous substances exists. Standard operating procedures will be developed to minimize contact with hazardous substances or with equipment that has contacted hazardous substances. Decontamination will be performed in areas so that exposure of uncontaminated employees or equipment to contaminated employees or equipment will be minimized. Any one leaving a contaminated area will be appropriately decontaminated. All clothing and equipment leaving a contaminated area will be appropriately disposed of or decontaminated. Decontamination procedures will be monitored by the site health and safety officer to determine their effectiveness. If the decontamination procedures are found to be ineffective, appropriate steps will be taken to initiate corrective actions. Each plan will have instruction for the closure of the decontamination stations.

3.9 List of Personnel

Each health and safety plan will contain a listing of the responsible personnel which includes the name of the project manager and the health and safety officer. This section will also include a brief summary of the responsibilities for the project manager, health and safety officer and onsite field personnel.

3.10 Emergency Information

Each health and safety plan will have a section that lists the emergency contact numbers for the area. The list will include, as a minimum, the following telephone numbers:

- Owners' representative(s)
- Local law enforcement agency
- Local fire department
- Ambulance service
- Nearest poison control center
- EnSafe's Memphis office

As an attachment to the health and safety plan, the name, emergency room telephone number, and directions to:

- the nearest hospital
- the nearest hospital that is capable of handling a chemical exposure

In addition to the above information, this section will include the location for the nearest telephone, water supply and restroom facility. The section will also include a section on emergency procedures.

3.11 Forms

This section will list all forms associated with the health and safety plan such as:

- Plan Acceptance Form (all site employees must sign this form indicating that they have read and understand the Site Health and Safety Plan).
- Plan Feedback Form
- Accident Report Form
- Exposure History Form

Appendix A

Safety Plan Work Sheet

Safety Plan Work Sheet

(Site-Specific Safety Plan)

Site History and Description

A. Type of Site: Spill ❑ HW Site ❑ Other ❑

Description of Site: ______________________________

____

____

____

B. Activities Performed on Site Prior to Investigation/Cleanup:

____

____

____

C. Unusual Features (containers, buildings, dikes, power lines, terrain, bodies of water, etc.): ______________________________

____

____

D. Results of Previous Surveys:

____

____

E. Waste Types: Liquid ❑ Solid ❑ Gas/Vapor ❑

F. Characteristics: Toxic ❑ Flammable/Volatile ❑ Radioactive ❑
Reactive ❑ Corrosive ❑

G. Substances Toxicity (PEL/TLV) Quantity

____

____

____

____

____

____

H. Physical Hazards: Heat ☐ Cold ☐ Noise ☐ Radiation ☐
Other (specify): ____________________
Comments: ____________________
____
____

I. Weather: ____________________

Site Organization and Control

A. Work Areas Identified: ____________________

B. Decontamination Areas Identified: ____________________

C. Support Areas Established: ____________________

D. Site Security Established: ____________________

E. Sketch of Site Available: ____________________

Job Activities/Work Plans

A. Types of Activities to be Performed:

1. Drum: Excavation ☐ Sampling ☐ Staging ☐
Treatment ☐ Disposal ☐

2. Soil: Excavation ☐ Treatment ☐ Disposal ☐

3. Water Treatment: ____________________

4. Spill Cleanup: ____________________

5. Well Installation: ____________________

6. Other (specify): ____________________

B. Comments: ______________________________

____

____

Education and Training

Special Training Required for this site: No ☐ Yes ☐
If yes, specify types: ______________________________

____

____

Medical Surveillance

Special Medical Monitoring Required? No ☐ Yes ☐
If yes, (specify): ______________________________

____

____

____

Ambient Field Monitoring

A. Field Monitoring Equipment Needed for Site:

____

____

____

____

B. Monitoring Protocol (should correspond with work plans):

____

____

____

____

____

____

____

____

Levels of Protection

A. Job Activity: ______________ Level: ______________
List of Personal Equipment:
____
____
____
____

B. Job Activity: ______________ Level: ______________
List of Personal Equipment:
____
____
____
____

C. Job Activity: ______________ Level: ______________
List of Personal Equipment:
____
____
____
____

Safety Equipment List

A. First Aid: ______________________________
____
____
____

B. Fire Fighting: ______________________________
____
____
____

C. Communications (radios/signs): ______________________________
____
____
____

D. Personal Protective Equipment (SCBA, respirators, cartridges, suits, boots, gloves, hard hats, face shields, goggles, hearing protection, etc.):

____
____
____
____

E. Decontamination Equipment: ______________________________

____
____
____

F. Sanitation: Latrines ☐ Showers ☐ Hand washing ☐
Comments: ______________________________

____

Decontamination Procedures

A. Work Activities: ______________________________
Level of Protection: ______________________________
Decontamination Solutions: ______________________________
Procedures (By Station): ______________________________

____
____
____
____

B. Work Activities: ______________________________
Level of Protection: ______________________________
Decontamination Solutions: ______________________________
Procedures (By Station): ______________________________

____
____
____
____

Contingency Plans

A. **Local Sources of Assistance**

1. Hospital: (name): ____________________
(address): ____________________
(phone): ____________________
Directions: ____________________
____
____
____

2. Ambulance (name and number): ____________________
3. Fire Department (name and number): ____________________
4. Police (and number): ____________________
5. Site Phone Number: ____________________

B. **National or Regional Sources of Assistance**

1. EnSafe 1-901-372-7962
2. CHEMTREC (24 hours) 1-800-424-9300

The following may be reached through CHEMTREC:
- Chemical Manufacturer
- National Agricultural Chemical Association (NACA)
- Pesticides Safety Team Network
- Chlorine Emergency Plan (CHLOREP)
- Energy Research and Development Administration (ERDA) for radioactive materials

3. Association of American Railroads 1-202-293-4048
4. Center for Disease Control (biological agents) 1-404-633-5313
5. DOT, Office of Hazardous Materials (Transportation Regulatory Matters) 1-202-366-4488
6. EPA .... ________
7. National Response Center, NRC (oil and hazardous substances) 1-800-424-8802

C. **Special First Aid or Evacuation Procedures**

____
____
____
____

Appendix B

Drilling Safety Guide

Drilling Safety Guide B-2
Drill Rig Safety Supervisor B-2
Drill Rig Personnel Protective Equipment B-3
Drill Rig Housekeeping B-3
Maintenance Safety B-4
Safe Use of Hand Tools B-4
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Drilling Safety Guide

EnSafe is concerned about employee safety while working on or around drill rigs as well as when traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, and during maintenance of the drill rig. Every drill crew will have a designated safety supervisor. The safety supervisor will have the responsibility for ensuring that all drilling operations are conducted in a safe manner. All personnel working on, with, or around a drill rig will be under the jurisdiction of the rig safety supervisor.

Drill Rig Safety Supervisor

The safety supervisor for the drill crew will be the drill rig operator. However, the EnSafe safety officer still maintains the overall safety responsibility for the site. The drill crew safety supervisor is a direct representative of the site health and safety supervisor and will report any safety problems directly to the site health and safety officer. The drill rig safety supervisor will:

- Be the leader in using proper personal protective equipment. He/she will set an example for other personnel to follow.
- Enforce the requirements of the health and safety plan and take appropriate actions when other personal are not following the requirements of the health and safety plan.
- Ensure that all drill rig and associated drill rig equipment is properly maintained.
- Ensure that all drill rig operating personnel are thoroughly familiar with the drill operations.
- Enspect the drill rig and associated drill rig equipment for damage before starting drilling operations. Check for structural damage, loose bolts or nuts, correct tension in chains and cables, loose or missing guards or protective covers, fluid leaks, damaged hoses and/or damaged pressure gauges and pressure relief valves.
- Test all emergency and warning devices such as emergency shut-down switches at least daily (prior to starting drilling operations). Drilling will not be permitted until all emergency and warning devices are functioning.
- Conduct a safety briefing daily before starting drilling operations. Any new employee will receive a copy of the drilling operations safety manual, and the drill rig manufacturer's operating and maintenance manual.
- Ensure that each employee reads and understands the drill rig manufacturer's operating and maintenance manual.
- Observe the mental, emotional, and physical capabilities of each worker.
- Ensure that each drill rig has a first aid kit and fire extinguisher.
- Maintain a list of emergency contact telephone numbers. This list will be posted in a prominent location and each drill rig employee will be informed of the list's location.

Drill Rig Personnel Protective Equipment
For most geotechnical, mineral, and/or groundwater drilling, drill rig personal protective equipment will include the following:
- Hard hat
- Safety shoes with steel toe and steel shank (or equivalent)
- Gloves
- Safety glasses with side shields
- Close-fitting but comfortable clothes
- Hearing protection

It is important that clothing does not have loose ends, straps, drawstrings or belts, or other unfastened parts that might become caught in or on a rotating or translating part of the drill rig.

Rings, necklaces, or other jewelry will not be worn during drilling operations.

Additional protective equipment may be required by the Site-Specific Health and Safety Plan.

Drill Rig Housekeeping
The following housekeeping measures must be taken for all drilling operations.
- Suitable storage locations will be provided for all tools, materials, and supplies. The storage should be conveniently located and will provide for safe handling of all supplies.
- Drill tools, supplies, and materials will not be transported on the drill rig unless the drill rig is designed and equipped to carry drill tools, supplies, and materials.
- Pipe, drill rods, casing, augers, and similar drilling tools when stored will be stacked in a manner that will prevent spreading, rolling, or sliding.
- Penetration or other driving hammers will be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding, and other access ways will be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- Never store gasoline in a nonapproved container. Red, nonsparking, vented containers marked with the word gasoline will be used. The fill spout will have a flame arrester.
- Prior to drilling, adequate site clearing and leveling will be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling will not be started when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

Maintenance Safety

Well maintained drilling equipment makes drilling operations safer. When performing equipment/tool maintenance, the follow safety precautions will be followed:

- Safety glasses will be worn when maintenance is performed on drill rigs or drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to the rig or to lubricate fittings (except to make repairs or adjustments that can only be made while the engine is running).
- Always block the wheels or lower the leveling jacks or both. Set the hand brake before working under a drill rig.
- Release all pressure on hydraulic systems, the drilling fluid system, and the air operating system of the drill rig prior to performing maintenance.
- Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Allow time for the engine and exhaust to cool before performing maintenance on these systems.
- Never weld or cut on or near the fuel tank.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent.
- Follow the manufacturer's recommendations for quantity and type of lubricants, hydraulic fluids and coolants.
- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed during maintenance.
- Perform a safety inspection prior to starting drilling equipment after maintenance is performed.

Safe Use of Hand Tools

There are a large number of hand tools that can be used on or around a drill rig. The most important rule of hand tools is to use a tool for its intended purpose. The following are a few general and specific safety rules to follow when using hand tools.

- When using a hammer, wear safety glasses and require all others around you to wear safety glasses.
- When using a chisel, wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and stored in an orderly manner.
- Use wrenches on nuts, not pliers.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut, use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Do not push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-

off device. Always assume that you may lose your footing. To avoid serious injury if you fall, remove sharp objects from the area near you.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches will be wire brushed frequently to prevent accumulation of dirt and grease which cause wrenches to slip.
- Never use pipe wrenches in place of a rod holding device.
- Replace hock and heel jaws when visibly worn.
- When breaking tool joints on the ground or on a drilling platform, position hands so that fingers will not be smashed between the wrench handle and the ground or the platform if the wrench were to slip or the joint suddenly to let go.

Safety During Drilling Operations

- Do not drive a drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast, look up to check for overhead obstructions.
- Before raising the mast, all drill rig personnel (except the person raising the mast) and visitors will be cleared from the area immediately to the rear and sides of the mast. All drill rig personnel and visitors will be informed that the mast is being raised prior to raising the mast.
- All drill rig personnel and visitors will be instructed to stand clear of the drill rig immediately prior to and during starting of the engine.
- All gear boxes will be in the neutral position, all hoist levers will be disengaged, all hydraulic levers will be in the nonactuating positions, and the cathead rope will not be on the cathead before starting the drill rig engine.
- The drill rig must be leveled and stabilized with leveling jacks and/or solid cribbing before the mast is raised. The drill rig will be leveled if settling occurs after initial setup.
- The mast will be lowered only when the leveling jacks are down. The leveling jacks must be in the down position until the mast is completely lowered.
- Secure and/or lock the mast according to the drill rig manufacturer's recommendations before starting drilling operations.
- The drill rig must only be operated from the control position. If the operator must leave the control position, the rotary drive and the feed control must be placed in the neutral position. The drill engine will be shut down when the operator leaves the vicinity of the drill rig.
- Throwing or dropping of tools is not permitted. All tools will be carefully passed by hand between personnel or a hoist line will be used.
- When drilling within an enclosed area, ensure that fumes are exhausted out of the area. Exhaust fumes can be toxic and may not be detected by smell.
- Clean mud and grease from boots before mounting the drill platform. Use hand holds and railings. Watch for slippery ground when dismounting from the drill platform.
- Do not touch any metal parts of the drill rig with exposed flesh during freezing weather. Freezing of moist skin to metal can occur almost instantaneously.
- All unattended boreholes must be covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.

- Do not attempt to use one or both hands to carry tools when climbing ladders.

Working on Derrick Platforms

- When working on a derrick platform, us a safety belt and a lifeline. The safety belt will be at least 4 inches wide and will fit snugly but comfortably. The lifeline, will be less than 6 feet long and attached to the derrick.
- The safety belt and lifeline will be strong enough to withstand the dynamic force of a 250-pound weight falling 6 feet.
- A safety climbing device will be used when climbing to a derrick platform that is higher than 20 feet.
- The lifeline will be fastened to the derrick just above the derrick platform to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- Tools will be securely attached to the platform with safety lines. Do not attach a tool to a line attached to the wrist or other body part.
- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Derrick platforms over 4 feet above the ground will have toe boards and safety railings.

Working on the Ground

- Workers on the ground must avoid going under elevated platforms.
- Terminate drilling operations and, if possible, lower the mast during an electrical storm.
- Overhead and buried utilities must be located and marked on all boring location plans and boring assignment sheets.
- When there are overhead electrical power lines at or near a drilling site or project, consider all wire to be charged and dangerous.
- Watch for sagging power lines before entering a site. Do not lift power lines to gain entry. Call the utility to have them lift the power lines or to deenergize the power.
- Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:
  - — Power has been shut off and positive means taken to prevent the lines from being energized.
  - — Equipment, or any part, does not have the capability of coming within the following minimum clearance from energized overhead lines, or the equipment has been positioned and blocked to assure no part, including cables, can come within the minimum clearances listed in the adjacent table.

Power lines nominal system kv	Minimum required clearance
0-50	10 feet
51-100	12 feet
101-200	15 feet
201-300	20 feet
301-500	25 feet
501-750	35 feet
751-1000	45 feet

- While in transit with boom lowered and no load, the equipment clearance will be a minimum of 4 feet for voltages less than 50kv, 10 feet for voltages 51kv to 345kv, and 16 feet for voltages over 345kv.
- Before working near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter will be de-energized. The following precautions will be taken to dissipate induced voltages:
  - — The equipment will be provided with an electrical ground to the upper rotating structure supporting the boom.
  - — Ground jumper cables will be attached to materials being handled by boom equipment when electrical charge may be induced while working near energized transmitters. Crews will be provided nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load. Insulating gloves will be used.
- Continue to watch overhead power lines. Both hoist lines and overhead power lines can be moved toward each other by the wind.
- If there are any questions concerning drill rig operations on a site in the vicinity of overhead power lines, call the power company. The power company will provide expert advice as a public service.
- Look for warning signs indicating underground utilities. Underground utilities may be located a considerable distance away from the warning sign. Call the utility and jointly determine the precise location of all underground utility lines, mark and flag the locations, and determine the specific precautions to be taken to ensure safe drilling operations.

Wire Rope Safety

- All wire ropes and fittings will be visually inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware.
- Wire ropes must be replaced when inspection indicates excessive damage. The *Wire Rope User's Manual* may be used as a guide for determining excessive damage.
- Wire ropes that have not been used for a period of a month or more will be thoroughly inspected before being returned to service.
- All manufactured and end fittings and connections must be installed according to the manufacturer's specifications.
- Swivel bearings on ball-bearing type hoisting swivels must be inspected and lubricated daily to ensure that the swivel rotates freely under load.
- Do not drill through or rotate drill through a slipping device, do not hoist more that 10 feet of the drill rod column above the top of the last (mast), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool hoists while the rod column is being supported by a rod slipping device.

- Do not attempt to brake the fall of a drill rod column with your hands or by increasing tension on the rod slipping device.
- Wire ropes must be properly matched with each sheave. The sheave will pinch wire rope that is too large. Wire rope that is too small will groove the sheave. Once a sheave is grooved, it will severely pinch and damage larger sized wire rope.
- Use tool handling hoists only for vertical lifting of tools. Do not use tool handling hoists to pull on objects away from the drill rig.
- All hoisting hooks will be equipped with safety latches.
- When tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull for the hoist line or the feed mechanism of the drill.
- Minimize shock loading of a wire rope; apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Know the safe working load of the equipment and tackle. Never exceed safe working limits.
- Periodically inspect clutches and brakes of hoists.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope onto hoist drums with your hands.
- After installation of a new wire rope, the first lift must be a light load to allow the wire rope to adjust.
- Never leave a load suspended when the hoist is unattended.
- Never use a hoist line to ride up the mast.

Cathead and Rope Hoist Safety

- Keep the cathead clean and free of rust and oil and/or grease. The cathead must be cleaned with a wire brush when it becomes rusty.
- Check the cathead for rope-wear grooves. If a rope groove forms that is deeper than 1/8-inch, the cathead must be replaced.
- Always start work with a clean, dry, sound rope. A wet or oily rope may grab the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast. If the rope grabs the cathead or otherwise becomes tangled in the drum, release the rope and sound the alarm for all personnel to clear the area rapidly.
- The rope must not be permitted to contact chemicals.
- Never wrap the rope from a cathead around a hand, wrist, arm, foot, ankle, leg, or any other body part.
- Attach the hammer to the ropeusing a knot that will not slip, such as a bowline.

- A minimum of 18 inches must be maintained between the operating hand and the cathead drum when driving samplers, casing , or other tools. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground. Loosen grip on the rope as the hammer falls. Maintaining a tight grip on the rope increases the chances of being pulled into the cathead.
- Do not use a rope that is longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- The cathead operator must be on a level surface with good, firm footing conditions.

Auger Safety

- The drill rig must be level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM when starting an auger boring.
- Seat the auger head below the ground surface with an adequate amount of downward pressure prior to rotation.
- Observe the auger head while slowly engaging the clutch or rotation control and start rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply downward pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below the surface.
- Follow manufacturer's recommended methods for securing the auger to the power coupling.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never place feet under the auger section that is being hoisted.
- Stay clear of rotating augers and other rotating components of the drill rig.
- Never reach behind or around a rotating auger.
- Use a long-handle shovel to move auger cuttings away from the auger.
- Augers will be cleaned only when the drill rig is in neutral and the augers have stopped rotating.

Rotary and Core Drilling Safety

- Water swivels and hoist plugs must be lubricated and checked for frozen bearings before use.
- Drill rod chuck jaws must be checked periodically and replaced as necessary.
- The weight of the drill rod string and other expected hoist loads must not exceed the hoist and sheave capacities.
- Only the operator of the drill rig will brake or set a manual chuck to ensure that rotation of the chuck will not occur prior to removing the wrench from the chuck.

- The drill rod chuck jaws will not be used to brake drill rods during lowering into the hole.
- Drill rods will not be held or lowered into the hole with pipe wrenches.
- Do not attempt to grab falling drill rods with hands or wrenches.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction must be relieved or bled down prior to breaking the first tool joint.
- Use a rubber or other suitable rod wiper to clean rods during removal from the hole. Do not use hands to clean drilling fluids from the drill rods.
- Do not lean unsecured drill rods against the mast.

Appendix C

Work in Confined Spaces

Work in Confined Spaces C-2
Definitions C-2
Confined Space Entry Procedures C-2
Confined Space Operating Rules C-3
Task-Specific Precautions C-4
Confined Space Entry Permit C-6

Work in Confined Spaces

Definitions

Confined Space — any space having limited openings for entry and exit, not intended for continuous occupancy, and unfavorable natural ventilation which could contain or have produced dangerous concentrations of airborne contaminants or asphyxiants. Confined spaces may include, but are not limited to, storage tanks, manholes, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, trenches, vats, and open-top spaces more than 4 feet in depth such as pits, tubs, vaults, or any place with limited ventilation.

Explosive Atmosphere — any atmosphere which contains a concentration of flammable or combustible material in excess of 10% of the lower explosive limit.

Oxygen Deficient Atmosphere — any atmosphere having less than 19.5% by volume oxygen content.

Oxygen Enriched Atmosphere — any atmosphere having 22% by volume or more oxygen.

Toxic Atmosphere — any atmosphere having a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit or the Threshold Limit Value established by the American Conference of Governmental Industrial Hygienists.

Hazardous Atmosphere — any atmosphere having one or more of the following characteristics:

- Explosive Atmosphere
- Oxygen Deficient Atmosphere
- Oxygen Enriched Atmosphere
- Toxic Atmosphere

Confined Space Entry Procedures

Prior to entry into confined spaces, a written Confined Space Entry Procedure to identify and eliminate or control the hazards will be established.

The confined space entry procedure will be in accordance with National Safety Council Data Sheet 1-704-85, "Confined Space Entry Control System for R&D," or the American Petroleum Institute's Recommended Practice, "RP 2015 Cleaning Petroleum Storage Tanks," or the National Institute of

Occupational Safety and Health's, "Criteria for a Recommended Standard—Working in Confined Spaces" as appropriate.

The confined space entry procedure must consider such hazards as flammable, toxic, corrosive, or radioactive materials, oxygen deficiency, and inadvertent activation of electrical or mechanical equipment and fire protection systems such as CO_2 and Halon.

A confined space entry permit system must be established. A permit will be developed for each confined space and renewed at the beginning of each shift. Permits (initial and renewal) will be posted at all openings of every confined space.

Permits will include, but are not limited to, work location, description of work, employees assigned, entry date, time, isolation checklists, hazardous work hazards expected, fire safety precautions, personal safety, results of atmospheric tests performed, person performing those tests, and authorization and permit expiration time.

Confined Space Operating Rules

No one will enter a confined space where a known explosive or oxygen-enriched atmosphere exists.

Before entering a confined space, the work environment will be tested by a competent person using calibrated, approved equipment to determine the extent of potential hazards. If the atmosphere cannot be determined by testing, an Immediately Dangerous to Life and Health (IDLH) situation will be assumed. Evaluation will consider the potential for evolution of toxic substances as well as oxygen content. Testing for toxic substances will be performed prior to each entry and on a continuous or frequent (as stipulated in the Confined Space Entry Procedure) basis while personnel are working in the confined space.

Employees entering or working in IDLH atmospheres will wear positive pressure, self-contained breathing apparatus of an approved type or a combination pressure-demand air-line respirator with an integral 5 minute (minimum) emergency escape air supply. No employee will enter an IDLH atmosphere unless accompanied by another adequately protected employee or is wearing a safety line and safety harness tended by a person in a safe area having no other duties and who has the proper equipment available to assist the respirator wearer in case of an emergency. An effective signal system that will provide for the quick removal of an incapacitated person will be established prior to entry. Employees will be instructed and trained in the use of the self-contained breathing apparatus before exposure to IDLH atmospheres.

Mechanical ventilation must be sufficient to maintain a nonhazardous atmosphere. Persons working in an atmosphere where this is not possible will be equipped with the proper respiratory equipment, protective clothing, and a safety line and body harness. Entry into an oxygen deficient space will be made utilizing self-contained, positive-pressure breathing apparatus or air-line respirators equipped with an emergency escape air supply. Protective clothing and respiratory protection will not be used as a substitute for cleaning and ventilating of spaces.

Qualified/trained personnel working in confined spaces will be assigned in teams. One team member will be designated as the standby person. The standby person will remain outside the confined space in a safe area and be assigned no other conflicting duties. The standby person will be first aid and CPR qualified and well versed in the potential hazards associated with confined space entry. The standby person must be able to communicate (voice, radio, telephone, or signal) with those working in the confined space and with others to obtain assistance. In the event of an emergency, the standby person ***will not enter*** the confined space unless equipped with the proper rescue equipment and ***until a new standby person*** arrives. The appropriate rescue equipment must be immediately available to the standby person. A backup for the standby person will be predesignated and available in the general area.

Consideration will be given to the standby/rescue person's ability to physically remove incapacitated personnel from the confined space in case of an emergency. A hoist or other mechanical device may be required for personnel removal. Supervisors must be aware of any personnel with cardiac or respiratory problems.

Rescue and first aid equipment will be readily available. A rescue drill will be performed to insure that rescue equipment will fit through the confined space entry way, to test communications, and to increase awareness of the difficulty of rescue operations.

Task-Specific Precautions

Precautions will be taken to preclude the possibility of liquids, gases, or solids entering the confined space inadvertently during occupancy. Connecting pipelines must be blanked or separated before entry. Closing of valves will not be a satisfactory substitute.

Safe Clearance procedures must be followed in securing electrical systems, machinery, pressure systems, and rotating equipment.

If welding or cutting is to be performed in a confined space, local exhaust ventilation, other safety equipment, and additional fire protection requirements may be necessary.

If hazardous materials, such as paints, thinners, mineral spirits, etc., are to be used in a confined space, the safety and health information from the Material Safety Data Sheet must be incorporated into the confined space entry procedure.

Only explosion-proof lighting/equipment will be used in confined or enclosed spaces unless atmospheric tests have proven the space to be nonexplosive.

The nozzle of air, inert gas, and steam lines or hoses, when used in the cleaning or ventilation of tanks that contain explosive concentrations of flammable gases or vapors, must be bonded to the tank. Bonding devices will not be attached or detached in the presence of hazardous concentrations of flammable gases or vapors.

CONFINED SPACE ENTRY PERMIT

CLIENT:	PROJECT #:
LOCATION:	DATE:
PROJECT MANAGER:	SITE MANAGER:
LOCATION & DESCRIPTION OF CONFINED SPACE:	
PURPOSE OF ENTRY:	ENTRY AUTHORIZATION:
DATE OF ENTRY:	TERMINATION DATE:
DESCRIPTION OF HAZARDS OF THE PERMIT SPACE:	

AUTHORIZED ENTRANTS

NAME	OSHA TRAINING DATE			PHYSICAL DATE	RESPIRATOR FIT TEST DATE	
	40 HOUR	SUPERVISOR TRAINING	8 HOUR		HALF FACE	FULL FACE

AUTHORIZED ATTENDANTS

NAME	OSHA TRAINING DATE			PHYSICAL DATE	RESPIRATOR FIT TEST DATE	
	40 HOUR	SUPERVISOR TRAINING	6 HOUR		HALF FACE	FULL FACE

SPECIAL REQUIREMENTS	YES	NO	AVAILABLE AND CHECKED
LOCK OUT / TAG OUT			
LINES BROKEN - CAPPED OR BLANKED			
PURGE - FLUSH OR VENT			
VENTILATION			
SECURE AREA			
SELF CONTAINED BREATHING APPARATUS			
AIR PURIFYING RESPIRATOR			
ESCAPE HARNESS			
TRIPOD EMERGENCY ESCAPE HARNESS			
LIFELINES			
FIRE EXTINGUISHERS			
LIGHTING			
RESUSCITATOR - INHALATOR			
PERSONAL PROTECTION EQUIPMENT			
LEVEL A, B, C, or D ?			
MODIFICATIONS			
COMMUNICATION SYSTEM			
TYPE:			

REQUIRED TESTING	ALLOWABLE RANGE	YES	NO	FREQUENCY (TIMES PER DAY)
PERCENT (%) OXYGEN	+19.5 - 21.0 %			
LOWER EXPLOSION LIMIT (%)	< 10 %			
CARBON MONOXIDE	≤ 15 ppm			
HYDROGEN SULFIDE	≤ 5.0 ppm			
ORGANIC VAPORS	≤ 10.0 ppm			
MONITORING PERSONNEL (NAME):				

Appendix D

Temperature Exposure Guidelines

Temperature Exposure Guidelines: Heat Stress Information
from NIOSH 86-112 Health D-2
Safety Problems D-2
Health Problems D-2
- Heat Stroke D-2
- Heat Exhaustion D-2
- Heat Cramps D-3
- Fainting D-3
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- Rest Areas D-4
- Drinking Water D-5
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Individual Heat Stress Monitoring Log D-5
Cold Exposure D-6
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- Hypothermia D-6

Temperature Exposure Guidelines: Heat Stress Information from NIOSH 86-112 Health

Safety Problems

Safety problems are common to hot environments as heat tends to promote accidents due to the slipping of objects from sweaty palms, dizziness, or visual distortions from fogged safety glasses.

The frequency of accidents, in general, appears to be higher in hot environments than in more moderate environmental conditions. Working in a hot environment lowers the mental alertness and physical performance of an individual. Increased body temperature and physical discomfort promote irritability, and other emotional states which can cause workers to overlook safety procedures or to divert attention from hazardous tasks.

Health Problems

Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders.

Heat Sroke. Heat stroke is the most serious health problem associated with working in a hot environment. It occurs when the body's temperature regulatory system fails and sweating becomes inadequate. A heat stroke victim's skin is hot, usually dry, red, or spotted. Body temperature is generally 105°F or higher, and the victim can be mentally confused, delirious, convulsive, or unconscious.

Any person showing symptoms of heat stroke requires immediate hospitalization. First aid, including removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body should be administered immediately. Further treatment, at a medical facility, should include the continuation of the cooling process and the monitoring of complications which often accompany the heat stroke. Early recognition and treatment of heat stroke is the only means of preventing permanent brain damage or death.

Heat Exhaustion. Heat exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt. A worker suffering from heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.

In most cases, treatment involves resting the victim in a cool place and administering plenty of liquids.

Victims with mild cases of heat exhaustion generally recover quickly. Those with severe cases may require extended care. There are no known permanent effects.

CAUTION--Persons with heart problems or those on a "low sodium" diet who work in hot environments should consult a physician about potential health problems.

Heat Cramps. Heat cramps are painful spasms of the muscles that can occur times of high sweat without an adequate replacement of the body's salt. The drinking of large quantities of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly thereafter, the low salt level in the muscles can cause painful cramps. The affected muscles may be part of the arms, legs, or abdomen; but tired muscles (those used in performing the work) are generally the ones most susceptible. Cramps may occur during or after work hours and may be relieved by ingesting salted liquids.

CAUTION--Persons with heart problems or those on a "low sodium" diet who work in hot environments should consult a physician about potential health problems.

Fainting. A worker who is not accustomed to hot environments and who stands immobile in the heat can faint. Due to the body's attempts to control internal temperature, enlarged blood vessels in the skin and lower part of the body may pool blood rather than returning to the heart to be pumped to the brain. Upon lying down, the worker should soon recover. By keeping active and moving around, blood should be prevented from pooling and the patient can avoid further fainting.

Heat Rash. Heat rash is likely to occur in hot, humid environments where heat is not readily evaporated from the surface of the skin leaving the skin wet most of the time. Sweat ducts become plugged, and a skin rash can develop. When the rash is extensive or complicated by infection, heat rash can be very uncomfortable and may reduce a worker's performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

Transient Heat Fatigue. Transient heat fatigue refers to the temporary state of discomfort and mental or psychological strain arising from prolonged heat exposure. Workers unaccustomed to the heat are particularly susceptible and can suffer to varying degrees, a decline in task performance, coordination, alertness, and vigilance. The severity of transient heat fatigue can be lessened by a period of gradual adjustment to the hot environment (heat acclimatization).

Preparing for Work in the Heat

One of the best ways to reduce the heat stress in workers is to minimize the heat in the work place. However, there are some work environments where heat production is difficult to control, such as outdoors where exposure to various weather conditions is likely.

Humans, to a large extent, are capable of adjusting to the heat. Adjusting to heat under normal circumstances, usually takes five to seven days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments or who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness can be affected by the heat in the work environment. Under such circumstances, the worker should be allowed to gradually reacclimatize to the hot environment.

Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. One way of reducing the potential for heat stress is to make the job less strenuous or lessen its duration by providing adequate rest time.

Number and Duration of Exposures. Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions.

Rest Areas. Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. Rest areas should be as close to the work area as possible, and provide shade. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

Drinking Water. In the course of a day's work in the heat, a worker may produce as much as two to three gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. Most workers exposed to hot conditions drink less fluids than needed due to an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink five (5) to seven (7) ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. Whatever the temperature of the water, it must be palatable and readily available. Individual drinking cups should be provided--never use a common drinking cup.

Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets SHOULD NOT be used.

CAUTION--Persons with heart problems or those on a "low sodium" diet who work in hot environments should consult a physician about potential health problems.

Protective Clothing. Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing excessive clothing reduces the body's ability to lose heat into the air. When air temperature is higher than skin temperature, however, clothing can help to prevent the transfer of heat from the air to the body. The advantage of wearing additional clothes, however, may be nullified if the clothes interfere with the evaporation of sweat (such as rain slickers or chemical protective clothing).

Individual Heat Stress Monitoring Log

Name______________________ Date_______ Shift___________________

	Start of Shift	Mid-Shift	End of Shift
Ambient Air Temperature (°F)			
Pulse Rate			
Body Temperature (°F)			
Blood Pressure			
Weight (pounds)			
Fluid Intake (in ounces)			

Cold Exposure

Persons working outdoors in temperatures at or below freezing may experience frostbite or hypothermia. Extreme cold for a short time may cause severe injury to the surface of the body. Areas of the body that have a high surface-area-to volume ratio, such as fingers, toes, and ears are the most susceptible.

Two factors influence the development of cold injury: ambient temperature and the velocity of the wind. As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus the body cools suddenly when protective equipment is removed if the clothing underneath is soaked with perspiration.

Frostbite. Frostbite is a condition in which the cold forms ice crystals in the cells and tissues, dehydrating protoplasm and killing tissues. At the same time, circulation of the blood is blocked. Frostbite could lead to gangrene and amputation.

Frostbite damage occurs in several degrees:

- Frost nip, or incipient frostbite, is characterized by sudden blanching or whitening of the skin.
- When superficial frostbite occurs, the skin has a waxy or whitish look and is firm to the touch; however, the tissue underneath has retained it resiliency.
- In deep frostbite, the tissues are cold, pale, and solid. The injury is severe.

In addition to frostbite, other physiological reactions to cold may be experienced as well. Trench foot, for example, may result from prolonged exposure to low temperatures near, though possibly above, freezing. Walking on the foot is very painful. In very severe cases, the flesh dies and the foot may have to be amputated. Immersion foot is very similar although it is less severe. Although amputation is unusual, some mobility of the limb is lost.

Blisters may occur around the lips, nostrils and eyelids.

Chilblain (Pernio). Chiblain (Pernio) which is an inflammation of the hands and feet caused by exposure to cold and moisture, is characterized by a recurrent localized itching, swelling, and painful inflammation on the fingers, toes, or ears, produced by mild frostbite. Such a sequence produces severe spasms, accompanied by pain.

Hypothermia. Hypothermia occurs when the body loses heat faster than it can produce it. The initial reaction involves the constriction of blood vessels in the hands and feet in an attempt to conserve the heat. After the initial reaction, involuntary shivering begins in an attempt to produce more heat.

Temperature is only a relative factor in cases of hypothermia. Cases of exposure have occurred in temperatures well above freezing. Humidity is another important factor. Moisture on the skin and clothing will allow body heat to escape many times faster than when the skin and clothing are dry.

Hypothermia occurs when the body's core temperature drops below 96°F. When this happens, the affected person becomes exhausted. He may begin to behave irrationally, move more slowly, stumble, and fall. The speech becomes weak and slurred. If these preliminary symptoms are allowed to pass untreated, stupor, collapse, and unconsciousness occur, possibly ending in death.

Recommendations to reduce effects of cold exposure:

- Stay dry. When the temperature drops below 40°F, change perspiration soaked clothes frequently. When clothes get wet, they lose about 90% of their insulating value.
- Beware of the wind. A slight breeze carries heat away from bare skin much faster than still air. Wind drives cold air under and through clothing. Wind refrigerates wet clothes. Wind multiplies the problems of staying dry.
- Understand cold. Most hypothermia cases develop in temperatures between 30°F and 50°F. Cold water running down the neck and legs or cold water held against the body by sopping clothes causes hypothermia.
- Make adequate dry, warm shelter available.
- Provide warm drinks.

Never ignore shivering. Persistent shivering is a clear warning that a person is on the verge of hypothermia. Allow for the fact that exposure greatly reduces normal endurance. Physical activity may be the only factor preventing hypothermia.

Respiratory Protection Program Written Standard Operating Procedures

Prepared by

Environmental and Safety Designs, Inc.

5724 Summer Trees Drive
Memphis, Tennessee 38134

RECEIPT AND UNDERSTANDING OF

RESPIRATORY PROTECTION PROGRAM
WRITTEN STANDARD OPERATING PROCEDURES

I, ______________________________________, have read the EnSafe Respiratory Protection Program Written Standard Operating Procedures. In doing so, I understand its contents and, hereby, agree to abide by the policies and procedures contained within. Furthermore, I understand that failure to comply with those policies and procedures and all other established safety policies and procedures may result in disciplinary action up to and including termination of employment.

Signature _________________________________ Date_______________

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Respiratory Protection Program
Written Standard Operating Procedures

Environmental and Safety Designs, Inc. (EnSafe)

1.0 Policy Statement

It is the policy of EnSafe to provide its employees with a safe and healthful working environment. This is accomplished as far as feasible with accepted engineering controls and administrative controls. Where these methods are not feasible, respiratory protection is provided at no cost to the employees to reduce employee exposure to harmful airborne particulates and/or gases and vapors to concentrations which are predictably noninjurious to most individuals according to standards established by regulatory and/or professional organizations.

EnSafe's management has made a commitment to establish and maintain a respiratory protection program consistent with the goal of protecting our employees. It is, therefore, EnSafe's policy that all employees, when using respirators in the workplace or administrating the respiratory protection program, will adhere to the letter and intent of this written standard operating procedure.

2.0 Program Administration

The following individual has total and complete responsibility for the administration of the respiratory protection program:

Richard C. Barlow
Manager Health and Safety Services

This individual has the authority to act on any and all matters relating to the operation and administration of the respiratory protection program, and all employees will cooperate to the fullest extent.

3.0 Medical Evaluation

EnSafe initially, and periodically thereafter, makes an individual determination on each employee required to wear respiratory protection as part of his or her duties as to whether that employee can wear the required respirator without undue physical or psychological risk.

EnSafe does not allow any employee to wear a particular type of respirator if, in the opinion of a licensed physician, the employee might suffer undue physical or psychological harm due to wearing the respirator.

The following licensed physician determines the capability of each respirator wearer to physically and psychologically perform his or her normal work duties while wearing a respirator:

Charles W. Munn, M.D.
Bartlett Internal Medicine Group, P.C.
6385 Stage Road, Suite B
Bartlett, Tennessee 38134
(901) 373-7100

Attached as Appendix A are the determinations which are made. A determination is made initially upon employment, or change into a job classification requiring respiratory protection, and every twelve (12) months thereafter, with the following exceptions:

- An examination will be done when an employee terminates employment. The Company Doctor will be consulted for the contents of the exam. The exception to this is when the employee has had an exam within the previous six (6) months or there has been no site work since the time of the last medical examination.
- After any job-related injury or illness, there will be a medical examination to determine fitness for duty or for the need of any job restrictions. The Manager Health and Safety Services will review the results of this back-to-work examination with the Company Doctor prior to releasing the employee for work.
- After any non-job-related injury requiring medical attention that causes the employee to miss three (3) or more days of work. The Manager Health and Safety Services will review the results of this back-to-work examination with the Company Doctor prior to releasing the employee for work.
- Biological and medical monitoring for specific exposures will be done whenever warranted. This monitoring will be used to assess the adequacy of personal protective measures and work practices.

Copies of the medical evaluation on each respirator wearer are kept in the employee's medical file.

4.0 Use of Approved Respirators

Only those respirators jointly approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA) are purchased by EnSafe and used by its employees.

Employees are not allowed to purchase their own respirators and use them in any area controlled by EnSafe.

5.0 Hazard Evaluation for Respirator Selection

5.1 Hazard Evaluation

Selection of the proper respirator(s) to be used in any location or operation under the control of EnSafe is made only after a determination has been made as to the real and/or potential exposure of EnSafe's employees to harmful concentrations of contaminants in the workplace atmosphere.

This determination is under the direction of the following individual:

Richard C. Barlow
Manager Health and Safety Services

The determination is performed prior to commencing any routine or nonroutine task requiring respiratory protection. Periodically thereafter, but not less than every three (3) months, a review of the real and/or potential exposures is made to determine if respiratory protection continues to be required, and if so, if the previously chosen respirators still provide adequate protection.

Records of all hazard evaluations are on file at:

Environmental and Safety Designs, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134

5.2 Respirator Selection

Respirators are selected on the basis of the hazards to which the employees are exposed, as determined by periodic evaluations of workplace environmental conditions. Documentation of respirator selection is in Appendix C and is on file at:

Environmental and Safety Designs, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134

Respirators, appropriate to the hazard, are used only in those locations and/or job functions indicated.

6.0 Respirator Fitting and Training

6.1 Respirator Fitting

No employee is allowed to wear a respirator in a work situation until he or she has demonstrated that an acceptable fit can be obtained. This is done by utilizing the procedures set forth in Appendices B, C, and D. Subsequently, the employee wears only the same type of respirator with which he or she has been fitted.

Respirator fitting is done initially upon employment of all new employees whose work will require the use of respirators, or where an employee changes into a job classification which requires respirator protection. Refitting is done at least every twelve (12) months thereafter.

Individual fitting records are kept on each individual, and may be found as part of personnel file at:

Environmental and Safety Designs, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134

No attempt is made to fit a respirator on an employee who has facial hair which comes between the sealing periphery of the facepiece and the face, or if facial hair interferes with normal functioning of the exhalation valve of the respirator.

6.2 Respirator Training

Training of respirator wearers in the use, field maintenance, capabilities, and limitations of respirators is given initially upon employment to all new employees whose work will require the use of respirators, or where an employee changes into a job classification which requires respiratory protection. Retraining is given at least every twelve (12) months thereafter.

No employee is allowed to wear a respirator in a work situation until he or she has been trained.

Outlines of the training courses are presented in Appendix D. Records of the training given each employee are included in the personnel file that may be found at the following location:

Environmental and Safety Designs, Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134

7.0 Facial Hair, Eye and Face Protection, and Corrective Lenses

7.1 Facial Hair

No employee is allowed to wear a respirator in the workplace for either routine or nonroutine work if he has facial hair which comes between the sealing periphery of the facepiece and the face, or if facial hair interferes with the normal functioning of the exhalation valve of the facepiece.

7.2 Eye and Face Protection

Goggles, a face shield, or a welder's helmet may be worn with a respirator, provided that the device does not interfere with the normal positioning of the respirator on the face.

7.3 Corrective Lenses

Corrective lenses (or safety glasses) may be worn with a half mask or quarter mask facepiece, provided that the glasses do not interfere with the normal positioning of the respirator on the face.

Corrective glasses with temple bars are not allowed to be worn with full facepiece respirators. If corrective glasses are needed to perform normal work functions, EnSafe, at no cost to the employee, provides corrective glasses inside the full facepiece which do not interfere with the seal of the respirator.

The wearing of contact lenses is not allowed.

8.0 Issuance of Respirators

Respiratory protective devices are issued by the following persons at Environmental Safety and Designs, Inc.:

Phillip Coop
Richard C. Barlow
John H. Borowski

Only the above persons are permitted to issue respirators. Respirators are issued only to those employees who have been fit tested. Only a respirator on which an employee has been currently fitted and trained may be used by that employee.

9.0 Respirator Inspection and Maintenance

9.1 Inspection

Prior to each donning of a respirator, the wearer must inspect the device for defects according to the training received. No respirator may be worn with a known defect. If found defective during inspection, the respirator must be returned to the following individual:

Richard C. Barlow
Manager Health and Safety Services

During cleaning and maintenance, all respirators will be inspected for defects and worn or deteriorated parts will be replaced prior to reuse. No respirator with a known defect may be reissued for use. No attempt will be made to make repairs on any respirator beyond those repairs recommended by the manufacturer.

9.2 Maintenance

All respirators in routine use will be cleaned and sanitized on a periodic basis. Respirators used non-routinely will be cleaned and sanitized after each use, and filters and cartridges replaced. Detailed written maintenance procedures are presented in Appendix E.

10.0 Responsible Persons During Respirator Use

10.1 Supervisors

It is the responsibility of the following individuals to supervise the use of respirators and to ensure that respirators are used when they are required and in the manner in which the wearers have been trained. Those individuals are responsible to the Manager Health and Safety Services in all matters relating to respirator use.

Site Manager
Site Health and Safety Officer

10.2 Respirator Wearers

It is the responsibility of each respirator wearer to wear his or her respirator when and where it is required, and in the manner in which trained. It is the responsibility of each respirator wearer to ensure that the respirator is fully functional at all times, and to report any malfunction of the respirator to the appropriate supervisor.

It is the responsibility of each respirator wearer to guard against mechanical damage to the respirator, and to ensure that, when worn intermittently, the respirator is kept in a clean and sanitary condition between wearings.

It is the responsibility of each respirator wearer to ensure that, if the respirator is maintained by the wearer, that the respirator is cleaned and maintained as instructed. Otherwise, each respirator wearer returns the respirator for cleaning and maintenance as instructed.

11.0 Emergency Use Respirators (Self-Contained Breathing Apparatus)

11.1 Use

No employee is allowed to use a self-contained breathing apparatus (SCBA) during an emergency unless he or she is:

- Currently trained in its operation and use
- Currently medically qualified to wear the device

11.2 Training

Prior to being allowed to use a SCBA during an emergency, each employee who may be required to use SCBAs must undergo initial training specific to the device. Retraining must be given not less often than every twelve (12) months.

Appendix F presents the outline of the SCBA training program.

11.3 Medical Qualifications

No employee is allowed to use a SCBA during an emergency unless he or she is currently medically qualified to do so. A determination of the individual's capability of using the device must be made initially and not less than every twelve (12) months thereafter.

Copies of the medical evaluation for SCBA use of each wearer are kept in the employee's medical file.

11.4 Inspection

SCBAs must be inspected monthly, using the manufacturer's recommendations. Records of the results of these inspections are in Appendix F.

Any unit found defective during an inspection will be removed from service until the defects are corrected.

11.5 Maintenance

SCBAs are maintained according to the manufacturer's instructions. No attempt will be made to make repairs beyond these instructions. Periodically, as recommended by the manufacturer, each SCBA will be removed from service and sent to the manufacturer's factory or an authorized service station for overhaul and calibration.

Compressed air cylinders must be hydrostatically tested according to the SCBA manufacturer's recommendations, and also the regulations of the Department of Transportation. Cylinders on which the hydrostatic testing date has lapsed must be removed from service until tested.

Records on each SCBA are in Appendix F.

12.0 Program Evaluation

A periodic review and evaluation of the respirator program will be made not less than every twelve (12) months. A written report must be made of each evaluation. For each deficiency noted in the evaluation, a written response must be prepared affirming or denying the deficiency, and the action taken to correct the deficiency if affirmed.

Copies of the written evaluations and the responses are in Appendix G.

Appendix A

Medical Evaluation (Form A) 10
Physician's Certification 12
Recommendations to Examining Physician 13

Form A

Medical Evaluation

Company: ______________________________

To: ______________ **M.D./O.D.** ______________________

______________ **Employee:** ______________________

______________ **Ident No.:** ______________________

This employee will be required to wear respiratory protective devices as part of his/her normal work activities. This company is required to abide by regulations concerning use of respiratory protective devices which have been established by the United States Department of Energy and/or the United States Occupation Safety and Health Administration of the United States Department of Labor. Both of these agencies require or recommend that a periodic medical evaluation be made of the employee's physical ability to perform the work while using the required respiratory equipment.

To meet the letter and intent of the pertinent requirements, this company requests that you make a professional determination of the above employee's capability of wearing respiratory protective equipment. To assist you in the determination, listed below is a summary of the conditions under which respiratory protection will be used.

1. The employee will potentially be exposed to the following airborne contaminants:

   a. ______________________________

   b. ______________________________

   c. ______________________________

   d. ______________________________

2. The respiratory protective device will be worn approximately _____ hours per day, _____days per week.

3. Air-purifying respiratory protective device(s) will be of the following types, and may impose the resistances listed during inhalation:

Type of Respirator	**Inhalation Resistance (mm H_2O)**
❑ Disposable Dust Mask	12-15
❑ Quarter or Half Mask, or Full Facepiece	30-85

4. The employee will ❑ / will not ❑ be required to wear a self-contained breathing apparatus (SCBA) weighing up to 35 pounds.

Physician's Certification

I have examined the individual named above and certify that the following is true, in my professional opinion, pursuant to the above-named individual wearing respiratory protective equipment as a part of his or her work activities.

- ☐ The individual exhibited no physical conditions which may cause difficulty in wearing any type of respiratory protective device.
- ☐ The individual exhibited no physical conditions which may cause difficulty in wearing any type of respiratory protective device, other than a self-contained breathing apparatus (SCBA) weighing up to 35 pounds.
- ☐ The individual exhibited one or more physical conditions which may cause difficulty in wearing a respiratory protective device which creates a negative pressure inside the facepiece upon inhalation, and therefore consideration should be given by the employer to restricting this individual to wearing only positive pressure devices.
- ☐ The individual exhibited one or more physical conditions which could be aggravated by wearing a self-contained breathing apparatus (SCBA) weighing up to 35 pounds, or physical injury could result by wearing same.
- ☐. Because of poor uncorrected vision, the employee should not be allowed to wear a full facepiece respirator unless it has corrective lenses installed.
- ☐ Because of one or more physical conditions, the individual should not be allowed to wear any type of respiratory protective device.

(Signed) ______________________M.D./O.D.
(Date) ______________________

****

Additional Comments

____
____
____
____
____

Recommendations to Examining Physician

It is recommended by the American National Standards Institute standard Z88.2-1980, "Practices for Respiratory Protection," that a physician should consider the following when making a determination of the ability of an individual to wear a respirator. You may wish to consider evidence of the following conditions in your examination:

1. Emphysema
2. Chronic obstructive pulmonary disease
3. Bronchial asthma
4. X-Ray Evidence of pneumoconiosis
5. Evidence of reduced pulmonary function
6. Coronary artery disease or cerebral blood vessel disease
7. Severe or progressive hypertension
8. Epilepsy, grand mal or petit mal
9. Anemia, perricious
10. Diabetes, insipidus or mellitus
11. Punctured eardrum
12. Pneumomediastinum gap
13. Communication of sinus through upper jaw to oral cavity
14. Breathing difficulty when wearing a respirator
15. Claustrophobia or anxiety when wearing a respirator

To assist you in making these determinations, the American National Standards Institute standard Z88.6-1982, "Physical Qualifications for Respirator Use," includes a medical questionnaire which may be useful in obtaining pertinent information from the employee.

In addition, we request that you make a determination of the following:

1. If the employee will be required to wear a SCBA, can he or she carry the maximum of 35 pounds with safety?

2. Is the employee's vision sufficiently good to allow wearing a full facepiece respirator without the installation of corrective lenses inside the facepiece?

If a pulmonary function test is performed as part of your evaluation, you may want to consider the following criteria, taken from ANSI Z88.6-1982 in considering restrictions on the use of respirators:

FVC	Less than 80% of predicted
$FEV_{9.0}$	Less than 70% of predicted

If the employee is required to perform heavy or streanuous exercise while wearing a respirator, it is suggested that an additional determination be made of the 15-second MVV. A suggested criterium may be found in ANSI Z88.6-1982.

Appendix B

Hazard Assessment (Form B) 16
Hazard Evaluation (Form C) 17
Contaminant Characteristics (Form D) 19

Hazard Assessment

Hazard Assessment	Location	Date

Form B

Form C

Hazard Evaluation

Date:____________________

Location: ____

____

Operation or Activity: ____

____

____

Personal Sample ❑ or Area Sample ❑

Location of Area Sampler or Name of Person Sampled: __________________________

____

____

Contaminant(s) Sampled: ____

____

____

Sampling Method and Equipment Used: ___________________________________

____

____

Brand of Sampler: ____________________ Model No: ____________________
Serial Number: ______________________ Calibration Date: _________________

Analytical Method: ____

____

____

____

____

Sampling Results							
Sample Number	Sampling Time		Flow Rate (lpm)	Total Volume (l)	TWA Exposure	TWA Exposure (8 hour)
	On	Off				

Respirator(s) Chosen:

Brand ______________________ Model ______________________

Brand ______________________ Model ______________________

Brand ______________________ Model ______________________

Form D

Contaminant Characteristics

Date: ______________________

Location or Area: ____

Operation or Activity: ____

____

____

____

****

Material Identification

		Material A	Material B
1.	Materials:		
a.	Chemical Name	______________	______________
b.	Trade Name	______________	______________
c.	Formula	______________	______________
d.	Vapor Pressure	______________	______________

Permissible Exposure Limits

		Material A	Material B
2.	Permissible Time-Weighted Average (TWA) Exposure Limits:		
	a. ACGIH	____________	____________
	b. OSHA	____________	____________
	c. Other	____________	____________
3.	Permissible Short-Term Exposure Limits:		
	a. ACGIH	____________	____________
	b. OSHA	____________	____________
	c. Other	____________	____________

4. Permissible Time-Weighted Average (TWA) Exposure Limit of Mixture Based on Air Sampling Data: ____________

Toxicological Information

		Material A Yes	Material A No	Material B Yes	Material B No
5.	Known or Suspected Carcinogen	❑	❑	❑	❑
6.	Known or Suspected Teratogen	❑	❑	❑	❑
7.	Known or Suspected Mutagen	❑	❑	❑	❑
8.	Adsorbed by Skin	❑	❑	❑	❑
9.	Eye Irritant	❑	❑	❑	❑
10.	IDLH Concentration	____________		____________	
11.	Lowest Concentration Where Irritation Occurs	____________		____________	

Flammability

		Material A	Material B
12.	Upper Limit (v/o)	____________	____________
13.	Lower Limit (v/o)	____________	____________

Conditions of Use

		Material A	Material B
14.	Form	Solid ❑ Gas or Vapor ❑ Liquid ❑	Solid ❑ Gas or Vapor ❑ Liquid ❑
15.	If Gas or Vapor, what type?	Organic Vapor ❑ Acid ❑ Other ❑	Organic Vapor ❑ Acid ❑ Other ❑
16.	Type of Exposure	Continuous ❑ Intermittent ❑	Continuous ❑ Intermittent ❑
17.	Maximum Expected Concentration	____________	____________
18.	Duration of Exposure to Maximum Concentration	____________	____________
19.	Frequency of Exposure per 8 hours	____________	____________
20.	Minimum Separation Between Exposures	____________	____________
21.	Possibility of Oxygen Deficiency	Yes ❑ No ❑	Yes ❑ No ❑

Respirator Wearer Activity

22. Usual Activity — Sedentary ☐ Mobile ☐

23. Estimated Time to Escape (Minutes) __________

24. Routine Use Respirator(s) Suitable for Escape — Sedentary ☐ Mobile ☐ Moderate ☐ Heavy ☐

Respirator Use in Emergencies

25. Possibility of IDLH Atmosphere? Yes ☐ No ☐

26. Estimated Time to Escape (Minutes) __________

27. Routine Use Respirator(s) Suitable for Escape — Yes ☐ No ☐

28. Reentry Required use of SCBA's? Yes ☐ No ☐

29. Location of SCBA's for Reentry:

    1. ______________________________

    2. ______________________________

****

Additional Details

30. ______________________________

Appendix C

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Respirator Selection (Form E) 26

Respirator Selection Records

Respirator Selection

1. The employee shall be allowed to select the most comfortable respirator from an array of various sizes and manufacturers.

2. The selection process shall be conducted in a room separate from the fit test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension, and how to assess a "comfortable respirator." A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This may not constitute his formal training on respirator use, only a review.

3. The employee should understand that he is being asked to select the respirator which provides the most comfortable fit for him. Each respirator represents a different size and shape and, if fit properly, will provide adequate protection.

4. The employee holds each facepiece up to his face and eliminates those which are obviously not giving a comfortable fit. Normally, selection will begin with a half-mask and if a fit cannot be found here, the subject will be asked to go to the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

5. The more comfortable facepieces are recorded; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in 6. below. If the employee is not familiar with using a particular respirator, he shall be directed to don the mask several times and to adjust the straps each time, so that he becomes adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the employee:
   - ☐ Chin properly placed
   - ☐ Positioning of mask on nose
   - ☐ Strap tension
   - ☐ Fit across nose bridge
   - ☐ Room for safety glasses
   - ☐ Distance from nose to chin
   - ☐ Room to talk
   - ☐ Tendency to slip
   - ☐ Cheeks filled out
   - ☐ Self-observation in mirror
   - ☐ Adequate time for assessment

7. The employee shall conduct the conventional negative- and positive-pressure fit checks (e.g., see ANSI Z88.2-1980). Before conducting the negative- or positive-pressure checks, the subject shall be told to "seat" his mask by rapidly moving the head side-to-side and up and down, taking a few deep breaths.

8. The employee is now ready for fit testing.

9. After passing the fit test, the employee shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

10. The employee shall be given the opportunity to select a different facepiece and be retested if during the first two weeks of on-the-job wear the chosen facepiece becomes unacceptably uncomfortable.

Respirator Selection

Respirator Selection	Location	Date

Form E

Appendix D

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Respirator Fitting Record (Form F) 36

Respirator Training Outlines

I. **Training of Supervisors** - A supervisor—that is, a person who has the responsibility of overseeing the work activities of one or more persons who must wear respirators—shall be given training to ensure the proper use of respirators. Supervisor training shall include the following subjects:

1. The basic respiratory-protection practices.
2. The nature and extent of respiratory hazards to which persons under his supervision may be exposed.
3. The principles and criteria of selecting respirators.
4. The training of respirator wearers.
5. The issuance of respirators.
6. The inspection of respirators.
7. The use of respirators, including monitoring of use.
8. The maintenance and storage of respirators.
9. The regulations concerning respirator use.

II. **Training of Person Issuing Respirators** - A person assigned the task of issuing respirators to persons who must wear respirators for protection against harmful atmospheres shall be trained to ensure that the correct respirator is issued for each application.

III. **Training of Respirator Wearers** - The minimum training of each respirator wearer shall include the following elements:

1. The reasons for the need of respiratory protection.
2. The nature, extent, and effects of respiratory hazards to which the person may be exposed.

3. An explanation of why engineering controls are not being applied or are not adequate and of what effort is being made to reduce or eliminate the need for respirators.

4. An explanation of why a particular type of respirator has been selected for a specific respiratory hazard.

5. An explanation of the operation, and the capabilities and limitations, of the respirator selected.

6. Instruction in inspecting, donning, checking the fit of, and wearing the respirator.

7. An opportunity for each respirator wearer to handle the respirator, learn how to don and wear it properly, check its seals, wear it in a safe atmosphere, and wear it in a test atmosphere.

8. An explanation of how maintenance and storage of the respirator is carried out.

9. Instructions in how to recognize and cope with emergency situations.

10. Instructions as needed for special respirator use.

11. Regulations concerning respirator use.

IV. Each respirator wearer shall be retrained annually.

Fit-Testing Procedures

I. Qualitative Fit-Testing Protocol for Isoamyl Acetate (Gases/Vapors)

A. Odor Threshold Screening

1. Three 1-liter glass jars with metal lids (i.e., Mason or Ball Jars) are required.

2. Odor-free water (e.g., distilled or spring water) at approximately 25°C shall be used for the solutions.

3. The isoamyl acetate [IAA (also known as isopentyl acetate)] stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor-free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

4. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but may not be connected to the same recirculating ventilation system.

5. The odor test solutions are prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two or three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

6. A test blank is prepared in a third jar by adding 500 cc of odor free water.

7. The odor test and test blank jars shall be labeled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically dried off and switched to prevent people from thinking the same jar always has the IAA.

8. The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2):

   "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

9. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed to prevent olfactory fatigue in the subject.

10. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

11. If the test subject correctly identifies the jar containing the odor test solution he may proceed to respirator selection and fit testing.

B. Fit Test

1. The fit test chamber shall be substantially similar to a clear 55 gallon drum liner suspended inverted over a 2-foot diameter frame, so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

2. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

3. After selecting, donning, and properly adjusting a respirator himself, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hook, to prevent general room contamination.

4. A copy of the following test exercises and "Rainbow (or equally effective) Passage" shall be taped to the inside of the test chamber. (Approximately one minute for each test.)

Test Exercises

a. Normal breathing.
b. Keep breathing. Be certain breaths are deep and regular.
c. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his head is at either side.
d. Nodding head up-and-down. Be certain motions are complete and made about every second. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head is in the fully upright position.
e. Talking. Talk aloud and slowly for several minutes. The following paragraph is called the "Rainbow Passage." Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.
f. Normal breathing.

Rainbow Passage:

"When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow."

5. Each test subject shall wear his respirator for at least 10 minutes before starting the fit test.

6. Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel or other porous absorbent single-ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

7. Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject to explain the fit test, the importance of his cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

8. If at any time during the test the subject detects the banana-like odor of IAA, he shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

9. Upon returning to the selection room the subject shall remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, etc. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

10. If a person cannot be fitted with half-mask respirators, include full facepiece models in the selection process. When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having him break the face seal and take a breath before exiting the chamber.

11. When the test subject leaves the chamber he shall remove the saturated towel, returning it to the test conductor. To keep the area from being contaminated, the used towels shall be kept in a self-sealing bag. There is no significant IAA concentration buildup in the test chamber from subsequent tests.

II. Qualitative Fit-Testing Protocol for Irritant Smoke (Particulates)

A. Respirator Selection

The same respirators that were successfully used in the isoamyl acetate test will be used for the irritant smoke test, except that the respirator will be equipped with NIOSH approved cartridges for particulates.

B. Fit Test

1. The test subject shall be allowed to smell a weak concentration of irritant smoke to familiarize himself with the characteristic odor.

2. After selecting, donning, and properly adjusting a respirator himself, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hook, to prevent general room contamination.

3. The test conductor shall review this protocol with the test subject before testing.

4. Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA Part No. 5645, or equivalent. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

5. Advise the test subject that the smoke can be irritating to the eyes and instruct him to keep his eyes closed while the test is performed.

6. The test conductor shall direct the stream of irritant smoke from the tube towards the face seal area of the test subject. He shall begin at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

7. The following exercises shall be performed while the respirator seal is being challenged by the smoke. Each shall be performed for one minute.
   a. Normal breathing.
   b. Deep breathing.
   c. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his head is at either side.

d. Nodding head up and down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head is in the fully up position.
e. Talking — slowly and distinctly, count backwards from 100.
f. Normal breathing.

8. If the irritant smoke produces an involuntary reaction (cough) by the test subject, the test conductor shall stop the test. In this case the tested respirator is rejected and another respirator shall be selected.

9. Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube to determine whether he reacts to the smoke. Failure to evoke a response shall void the fit test.

10. Steps B4 and B9 of this protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents (IAA, irritant smoke).

Form F

Respirator Fitting Record

Fitting Test Codes

Qualitative
1. Isoamyl Acetate (IAA)
2. Irritant Smoke
3. Saccharin
4. Other (Describe)

____

____

Quantitative

5. Oil Mist
6. Sodium Chloride
7. Other (Describe)

____

____

____

Employee's Name: ______________________

Employee's Identification Code: ______________________

Date	Test Code	Fitter's Initials	Pass (P) or Fail (F)	Respirator Manufacturer	Respirator Size

Notes:

____

____

____

____

____

Appendix E

Respirator Maintenance Procedures 38

Respirator Maintenance Procedures

I. Cleaning and Disinfection of Respirators

Routinely used respirators will be cleaned and disinfected as frequently as necessary to insure that proper protection is provided. The following procedures will be utilized in the event the manufacturer's procedures are unavailable:

1. Remove all cartridges (canisters) and filters plus gaskets and seals not affixed to their seats.

2. Loosen harness adjustment straps.

3. Remove exhalation valve cover.

4. Remove exhalation valve and inhalation valves.

5. Wash facepiece in cleaner/sanitizer powder with warm water, preferably at 120°F to 140°F. Wash components separately from face mask, as necessary. Heavy soil may be removed from surfaces with a hand brush.

6. Remove all parts from wash water and rinse twice in clean warm water.

7. Allow parts to air dry in a designated clean area.

8. Wipe facepieces, valves, and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

9. Reassemble respirator.

II. Storage of Respirator

Respirators will be stored in a designated location that protects them from dust, sunlight, heat, extreme cold, excessive moisture or damaging chemicals. Do not store respirator with adjustment straps over the front of the facepiece.

III. Cleaning and Disinfection of Self-Contained Breathing Apparatus

1. SCBA units must be cleaned and sanitized after each day's use. After decontamination, sponge off and wipe down the tank, backpack harness, and regulator. Avoid getting cleaning solutions in the regulator, i.e., do not dunk, soak, hose off, etc.

2. Detach breathing hose from facemask. Wash each in a bucket of water and sanitizer solution. It is not usually necessary to disassemble the facemask. Rinse with warm water.

3. Allow breathing hose and facemask to air dry in a designated area.

4. Reassemble respirator.

IV. Storage of SCBA

1. Cylinder is refilled as necessary and unit is cleaned and inspected.

2. Cylinder valve is closed.

3. High-pressure hose connector is tight on cylinder.

4. Pressure is bled off high-pressure hose and regulator.

5. Bypass valve is closed.

6. Mainline valve is closed.

7. All harness straps are loosened and laid straight.

8. Facepiece is properly stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, and damaging chemicals. Do not store respirator with adjustment straps over lens facepiece.

9. Units must be stored in a designated area.

Appendix F

Emergency Respirator Training Outline ....
Emergency Respirator Maintenance Procedures ....
Emergency Respirator Inspection Records ....

Appendix G

Evaluation of Respirator Program Effectiveness 42
(EnSafe does not have any Emergency Respirators.)

Evaluation of Respirator Program Effectiveness

Periodic evaluation of the effectiveness of the respirator program is essential to ensure that persons are being provided with adequate respiratory protection. Improvement of the program and elimination of any deficiencies in the program cannot be carried out unless the program is appraised for effectiveness at periodic intervals. The effectiveness of the respirator program shall be evaluated at least annually and corrective action shall be taken to correct defects found in the program.

Wearer acceptance of respirators is an important matter to consider in evaluating the effectiveness of the respirator program. Respirator wearers shall be consulted periodically about their acceptance of wearing respirators. Numerous factors include: comfort, resistance to breathing, fatigue, interference with vision, interference with communications, restriction of movement, interference with job performance, and confidence in the effectiveness of the respirator to provide adequate protection.

Frequent inspection of the operation of the respirator program shall be conducted to ensure the proper types of respirators are selected, that respirator wearers are trained properly, that the correct respirators are issued and used, that respirators are worn properly, that respirators being used are in good operating condition, that respirators are inspected and maintained properly, that respirator storage is satisfactory, that respiratory hazards are monitored, and that medical and, when necessary, bioassay surveillance of respirator wearers is carried out.

Medical and, when necessary, bioassay surveillance of respirator wearers shall be conducted periodically to determine if respirator wearers are being provided with adequate respiratory protection. These data, when considered with the results of monitoring respiratory hazards, can serve as an indication of the degree of protection provided by the respirators and the effectiveness of the respirator program.

The results of investigating wearer acceptance of respirators, inspecting respirator program operation, and appraising protection provided by respirators shall be utilized to evaluate the effectiveness of the respirator program. Evidence of excessive exposure of respirator wearers to respiratory hazards shall be followed up by investigation to determine why inadequate respiratory protection was provided. Action shall be taken to correct any defects found in the respirator program. The findings of the respirator-program evaluation shall be documented, and this documentation shall list plans to correct faults in the program and target dates for the implementation of the plans.

Hazard Communications Program

Prepared by

Environmental and Safety Designs, Inc.

5724 Summer Trees Drive
Memphis, Tennessee 38134

RECEIPT AND UNDERSTANDING OF

HAZARD COMMUNICATIONS PROGRAM

I, ______________________________, have read the EnSafe Hazard Communications Program. In doing so, I understand its contents and, hereby, agree to abide by the policies and procedures contained within. Furthermore, I understand that failure to comply with those policies and procedures and all other established safety policies and procedures may result in disciplinary action up to and including termination of employment.

Signature ____________________________ Date______________

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Hazard Communications Program

1.0 Introduction

This document contains the provisions of the Environmental and Safety Designs, Inc. Hazard Communications Program. This program has been designed to ensure the communication of information to Environmental and Safety Designs, Inc. (EnSafe) employees on the nature of hazardous chemicals that they may encounter while working. The program specifications are intended to ensure compliance with the provisions of the "Hazardous Chemical Right-to-Know Law," enacted by the Tennessee Legislature in 1986. EnSafe is considered a nonmanufacturing employer as defined by this act.

The program covers all hazardous materials consumed, used, and generated by EnSafe. It is accessible for review by all EnSafe employees or designated representatives of the Tennessee Division of Occupational Safety and Health through the office of the EnSafe's Health and Safety Officer.

The EnSafe's Health and Safety Officer is responsible for establishing and maintaining the Hazard Communications Program.

2.0 Employee Rights

EnSafe recognizes its responsibility to inform its employees of their rights under the "Hazardous Chemical Right-to-Know Law" and has duly relinquished the following information:

- Every EnSafe employee will receive information regarding the hazardous substances to which they may be exposed. This information will be disseminated in the form of verbal and visual training, posting of signs, MSDSs, container labeling, and any other appropriate programs.
- Every EnSafe employee may have their representative receive information regarding hazardous substances to which that employee may be exposed during employment with EnSafe.
- No employee will be discharged or discriminated against for exercising their rights provided under the Tennessee "Hazardous Chemical Right-to-Know Law."

All EnSafe employees will be informed of their rights under the law through employee training sessions and official TOSHA posters.

3.0 How to Comply with Tennessee's "Hazardous Chemical Right-to-Know Law"

Completed	Not Completed	Not Applicable		
☐	☐	☐	1.	Assign the EnSafe's Health and Safety Officer.
☐	☐	☐	2.	Put up TOSHA posters in an area where there is optimum visibility, where notices are generally posted.
☐	☐	☐	3.	Check and revise chemical workplace lists.
☐	☐	☐	4.	Add to your chemical workplace lists any chemicals or hazardous substances that are generated in your workplace, i.e., carbon monoxide from vehicles, welding fumes, etc.
☐	☐	☐	5.	Retain all Material Safety Data Sheets (MSDSs) for each chemical already on file and obtain current MSDSs for all new chemical purchases. (Make sure that the MSDS file is complete.)
☐	☐	☐	6.	File MSDSs in an accessible area where employee/representative may review with ease.
☐	☐	☐	7.	Insure that all containers are properly labeled, tagged, or marked in some way that indicates their contents and associated hazards.
☐	☐	☐	8.	Implement and maintain Written Hazard Determination and Hazard Communication Programs.
☐	☐	☐	9.	Train employees about the hazardous chemicals with which they work or may be exposed to in a foreseeable emergency.
☐	☐	☐	10.	Give annual refresher training courses as well as devise a plan to train new employees.
☐	☐	☐	11.	Submit workplace chemical list to the Assistant Director of TOSHA for hazardous chemicals normally used or stored in excess of 55 gallons and/or 500 pounds.
☐	☐	☐	12.	Submit workplace chemical list to the City Fire Chief for hazardous chemicals normally used or stored in excess of 55 gallons and/or 500 pounds.
☐	☐	☐	13.	Submit changes which occur in your chemical workplace lists annually.
☐	☐	☐	14.	Inform contractors of all hazardous substances that they might encounter while working at your facility and offer them review of any MSDS that they request.
☐	☐	☐	15.	Keep complete and accurate records of all employee training as well as accounts of MSDS review by employees/representatives, correspondence with suppliers, TOSHA authorities, and emergency response teams (fire department).

4.0 Posters

EnSafe has posted adequate notice, at locations where notices are generally posted, informing employees of their rights under the "Hazardous Chemical Right-to-Know Law."

5.0 Hazard Determination

In order to determine the hazardous nature of chemicals and other substances at your facility, rely on the following references:

- Existing literature sources.
- Material Safety Data Sheets (MSDSs) from suppliers or commercial sources.
- EnSafe does not foresee performing any scientific studies to determine the hazardous nature of substances consumed or produced.

Determining a Hazardous Substance:

- ❑ Develop a list of hazardous substances consumed or produced.
- ❑ Obtain a list from the Purchasing Department which shows all chemicals purchased for your workplace.
- ❑ Then review MSDSs and chemical workplace lists and determine which materials are hazardous. Finally, supervisors in each department will be consulted to help determine the completeness of the list.
- ❑ After a complete list of materials consumed and produced has been prepared, each material will be reviewed for hazardous components. Sources for determining whether a substance is hazardous will include, but not be limited to, the following:
  - — Department of Transportation (DOT) Hazard Classification as combustible liquid, compressed gas, explosive, flammable liquid, oxidizer, organic peroxide, pyrophoric liquid, flammable solid, or otherwise reactive or water reactive. These materials will be considered to have physical hazards.
  - — 29 Code of Federal Regulation (CFR) Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA).
  - — Threshold Limit Values for Chemical Substances in the Work Environment, American Conference of Governmental Industrial Hygienists (ACGIH), 1985-1986.
  - — National Toxicology Program (NTP), Third Annual Report on Carcinogens, 1983.
  - — International Agency for Research on Cancer (IARC) Monographs, Vols. 1-34.

6.0 Material Safety Data Sheet

The primary source of information regarding toxic substances or hazardous chemicals is the Material Safety Data Sheet (MSDS). EnSafe will maintain MSDSs on file for hazardous substances used within its facilities.

EnSafe will also develop MSDSs for all hazardous products produced by EnSafe. A guideline for reading a typical MSDS and definitions of several of the terms used in the MSDS follows.

6.1 Contents of MSDS

All MSDSs produced or retained by EnSafe should contain the following information.

- *Common Name* - Any designation used on the label that is used to identify a substance other than its chemical name.
- *Chemical Name* - The scientific designation of a chemical in accordance with the nomenclature systems used by the International Union of Pure and Applied Chemistry (IUPAC) or the chemical name.
- *CAS Number* - The identification number assigned by the Chemical Abstracts Service.
- *Manufacturer's Name and Address* - The name and address of preparer of the MSDS.
- *Emergency Telephone Number* - The number to be used in the event of an emergency to contact a responsible individual for receiving further information.
- *Date of Preparation* - The date that the MSDS was prepared or most recently altered.
- *Identity of Hazardous Components* - The chemical name, common name, and CAS number of all hazardous ingredients present within a mixture in quantities of one percent or greater. Any component identified as a carcinogen will be listed if present in quantities of 0.1 percent or greater. The chemical name, common name, and CAS number of all components present in quantities sufficient to present a physical hazard when present in the mixture will also be listed.
- *Physical and Chemical Properties* - The properties of the substance to include such items, when applicable, as boiling point, vapor pressure, flash point, specific gravity, flammable limits, solubility and reactivity in water, etc.
- *Physical Hazards* - The physical hazards associated with the substance to include any potential for fire, explosion or reactivity. Objects incompatible with the substance should be listed, along with any hazardous products produced during decomposition.
- *Health Hazards* - The health hazards associated with exposure to the hazardous substance to include any signs and symptoms of overexposure and any medical conditions which may be aggravated by exposure to the substance. All health hazards will be listed in lay terms so that workers can understand their meaning.
- *Routes of Entry* - All the potential routes by which a hazardous substance may enter an employee's body to include inhalation, ingestion, skin absorption, etc.
- *OSHA PEL* - U.S. Occupational Safety and Health Administration eight-hour time-weighted average Permissible Exposure Limit (PEL).
- *ACGIH TLV* - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV).

- *Other Exposure Limits* - Any other applicable exposure limits, such as Permissible Exposure Limits (PEL) enforced by the Tennessee Division of Occupational Safety and Health (TOSHA).
- *Carcinogens* - Whether a hazardous substance has been listed as a carcinogen (cancer-causing agent) by the National Toxicology Program (NTP) Third annual Report on Carcinogens, International Agency for Research on Cancer (IARC) Monographs Volumes 1-34, or by OSHA.
- *Precautions for Safe Handling and Use* - Includes precautions when handling and storing the hazardous substance, along with procedures to be taken when controlling or cleaning up any spills or leaks.
- *Control Measures* - Includes appropriate work practice methods and personal protective equipment to be utilized when working with or near the hazardous substance. Engineering control methods such as proper ventilation, will also be included within this section.
- *Emergency and First Aid Procedures* - Instructions for the treatment of individuals overexposed to the hazardous substance. The procedures will include steps for remedial action only, in many cases the individual will need to subsequently see a physician.

6.2 Acquiring MSDSs from Suppliers

MSDSs sent to EnSafe by suppliers will be retained and organized by common or trade name and be filed in the EnSafe's Health and Safety Officer's office, or other appropriate location. Responsibility for retaining and organizing MSDSs will be the responsibility of the EnSafe's Health and Safety Officer or other designated person.

MSDS folders will be readily accessible during all working hours. A centralized list of all hazardous products used at each facility will also be available at the EnSafe's Health and Safety Officer's office. Products will be listed by common or trade name as they appear on the MSDS.

If EnSafe has not received an MSDS from a supplier, the following procedures will be undertaken:

- If EnSafe has not received an MSDS from a supplier within five (5) days following receipt of a product, then the EnSafe's Health and Safety Officer will send the supplier a letter requesting a copy of the applicable MSDS.
- The EnSafe's Health and Safety Officer will notify, in writing, any employee requesting to see an MSDS, for a product which EnSafe has not received an MSDS, of the request made to the supplier for the MSDS and whether that supplier has responded.
- The EnSafe's Health and Safety Officer will notify the requesting employee of the MSDS within three (3) days following receipt of the MSDS.
- If a response has not been received from the supplier within 24 days following the request by EnSafe for a copy of the MSDS, then no employee shall be required to work with the hazardous chemical unless the EnSafe can demonstrate to the employee that the MSDS will be forthcoming.

- A written statement from the supplier that a chemical is not hazardous shall fulfill the requirement to supply an MSDS.
- There shall be no penalty to an employee for not doing work in the absence of an MSDS.
- A copy of any, or all, MSDSs shall be provided the Commissioner of the Department of Labor if requested.

6.3 MSDS Review Sign-in Sheet

Material Safety Data Sheet
Review Sign-in Sheet

Name	Date	Material Safety Data Sheets Reviewed

6.4 Chemical List and MSDSs

Appendix A contains a workplace chemical list for the chemicals used by EnSafe and the location of each chemical within the facility. A copy of each MSDS applicable to materials used, handled, or stored at Environmental and Safety Designs, Inc. follows.

7.0 Labeling

All products containing hazardous ingredients used at the facility will be inspected to ensure that labels comply with the labeling standard, including:

- Identity of hazardous material (common name as listed on the MSDS)
- Appropriate hazard warnings
- Name and address of manufacturer

EnSafe will ensure that any containers used to store hazardous chemicals will also be labeled, except for portable containers intended for the immediate use of the employee who placed the chemical in the portable container.

For hazardous chemicals produced in the facility, EnSafe will ensure that appropriate warning labels are placed on containers or in the workplace.

No employee shall be required to work with a hazardous chemical in an unlabeled container except for portable containers described above.

8.0 Employee Information and Training

EnSafe will provide all employees with information and training on the TOSHA Hazard Communications Standard, the Environmental and Safety Designs, Inc. Hazard Communication Program, and with any applicable material found in each employee's work area containing hazardous substances, or whenever new information or processes indicate that a new hazard may be found in the workplace.

The training program will include the following elements:

- An explanation of what an MSDS is and how employees can interpret information on the MSDS for those hazardous substances located in the employee's work area. The information is to include, but not be limited to, the health hazards associated with using the substance, proper handling procedures, use of appropriate personal protective equipment, and emergency procedures for spills, fire disposal, and first aid. In many cases, training will be provided for a class of substances rather than for each specific substance.
- New information which indicates significantly increased health risks to employees or protective measures necessary when working with a hazardous substance. Any significant new information will be transmitted to employees who may be working with the hazardous substance, either verbally or in writing, no later than 30 days following the discovery of the new relevant information.
- Employee right to personally receive information, or have their physician receive information on hazardous substances to which the employee may be exposed.
- Employee right not to be discriminated against for exercising their rights provided by the Tennessee "Hazardous Chemical Right-to-Know Law."

- Requirements of the TOSHA Hazard Communication Standard and of the location and availability of this written program.
- Operations in each employee work area in which hazardous substances are present.
- Methods and observations used to detect the presence or release of hazardous substances into the work area.
- Physical and health hazards associated with substances used in the work area, including measures employees can use to protect themselves, along with procedures EnSafe has taken to protect employees from exposure to hazardous substances.
- An explanation of the Environmental and Safety Designs, Inc. Hazard Communications Program, with details of the various provisions of the program.

An initial employee training session was provided by Environmental and Safety Designs, Inc. of Memphis, TN. All provisions of the employee training program, including future training sessions and updates, will be the responsibility of the EnSafe's Health and Safety Officer. An outline of the initial training program by Environmental and Safety Designs, Inc. is presented on the next page.

The training session will consist of a combination of slides, demonstrations, and lectures. Future training will consist of handout training materials, along with some lecturing. Documentation will be kept of each training session. Training sessions are mandatory and each employee will be required to sign an attendance sheet to verify their presence.

Annual refresher training shall be provided to all employees whose positions require contact with hazardous chemicals. In addition, all new employees will be trained if their positions require contact with hazardous chemicals.

Employee Training Session Outline

I. Introduction to Hazard Communication
- federal and state law
- exemptions
- employee rights
- Environmental and Safety Designs, Inc. program

II. Toxic Substances—General
- routes of exposure
- effects
- carcinogens
- monitoring

III. Material Safety Data Sheets
- components
- Environmental and Safety Designs, Inc. Program

IV. Labeling
- in-house
- commercial products

V. Hazardous Substances
- flammables
- corrosives
- solvents
- oils
- asbestos
- other (vapors and fumes)

VI. Personal Protective Equipment
- gloves
- respirators

9.0 Nonroutine Tasks

EnSafe will train each of its employees in the health hazards, appropriate work practices, and required personal protective equipment when performing nonroutine tasks. Each employee will be trained verbally in the specific hazards associated with a particular task. The training session will be documented by having each employee sign a sheet claiming that they have attended a special training session for the specific nonroutine task. The training and documentation will be the responsibility of the EnSafe's Health and Safety Officer.

Nonroutine Task Employee Sign-in Sheet

I, the undersigned employee of Environmental and Safety Designs, Inc., have attended a training course on Hazard Communications and have been informed of my rights under the "Hazardous Chemical Right-to-Know Law" in order to perform a nonroutine task for Environmental and Safety Designs, Inc.

Name	Date	Nonroutine Task

10.0 Informing Contractors

EnSafe will inform all contractors retained to perform services in the EnSafe facility of the presence of all hazardous materials that he or she might encounter while working in that facility. Contractors will be notified in the form of a letter stating that hazardous materials are located in the facility, and shall receive a copy of the chemical workplace list. Contractors will have accessibility to MSDSs for all applicable hazardous materials that they may come in contact with. Copies of applicable MSDSs will be made available to contractors through the office of the EnSafe's Health and Safety Officer.

11.0 Employee Training Records

11.1 Employee Training

Employee Training

I, the undersigned employee of Environmental and Safety Designs, Inc., have attended a training course on Hazard Communications and have been informed of my rights under the "Hazardous Chemical Right-to-Know Law."

Name	Date

11.2 New Employee

New Employee

As a new employee for Environmental and Safety Designs, Inc., I, the undersigned, have attended a training course on Hazard Communications and have been informed of my rights under the "Hazardous Chemical Right-to-Know Law."

Name	Date

11.3 Annual Refresher

Annual Refresher

I, the undersigned employee of Environmental and Safety Designs, Inc., was initially trained and have now received the annual refresher training which includes any significant changes in the chemicals encountered in the work environment, as well as any new associated health hazards, appropriate work practices, or required personal protective equipment.

Name	Date	Nonroutine Task

Appendix A

Workplace Chemical List

Appendix B

29 CFR 1910.1200
Hazard Communication

Copies of the federal regulations on the hazard communication standard can be found in 29 CFR 1910.1200. A listing of the variances for Tennessee are located in "OSHA and State, Employee Hazard Communication Program, Volume II" by Intereg Group, Inc., Chicago, IL 60646. Copies of both publications are available in the EnSafe library.

Budget under control number 12180010)

[§ 1910.1101 added at 51 F.R. 37002, October 17, 1986 effective October 17, 1986.]

[¶7686]

§ 1910.1200 Hazard communication.

[Note of OMB stay of three applications added at 53 F.R. 15035, April 27, 1988; removed at 54 F.R. 6888, February 15, 1989.]

(a) *Purpose.* (1) The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training.

(2) This occupational safety and health standard is intended to address comprehensively the issue of evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, and to preempt any legal requirements of a state, or political subdivision of a state, pertaining to the subject. Evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of material safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures. Under section 18 of the Act, no state or political subdivision of a state may adopt or enforce, through any court or agency, any requirement relating to the issue addressed by this Federal standard, except pursuant to a Federally-approved state plan.

(b) *Scope and application.* (1) This section requires chemical manufacturers or importers to assess the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training. In addition, this section requires distributors to transmit the required information to employers.

(2) This section applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

(3) This section applies to laboratories only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees; and,

(iii) Employers shall ensure that laboratory employees are apprised of

[The next page is 3867-3.]

the hazards of the chemicals in their workplaces in accordance with paragraph (h) of this section.

(4) In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this section applies to these operations only as follows:

(i) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(ii) Employers shall maintain copies of any material safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a material safety data sheet for sealed containers of hazardous chemicals received without a material safety data sheet if an employee requests the material safety data sheet, and shall ensure that the material safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and,

(iii) Employers shall ensure that employees are provided with information and training in accordance with paragraph (h) of this section (except for the location and availability of the written hazard communication program under paragraph (h)(1)(iii)), to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

(5) This section does not require labeling of the following chemicals:

(i) Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Environmental Protection Agency;

(ii) Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device, including materials intended for use as ingredients in such products (e.g. flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*) and regulations issued under that Act, when they are subject to the labeling requirements under that Act by the Food and Drug Administration;

(iii) Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 *et seq.*) and regulations issued under that Act, when subject to the labeling requirements of that Act and labeling regulations issued under that Act by the Bureau of Alcohol Tobacco, and Firearms; and,

(iv) Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those Acts, or regulations issued under those Acts by the Consumer Product Safety Commission.

(6) This section does not apply to:

(i) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.), when subject to regulations issued under that Act by the Environmental Protection Agency;

(ii) Tobacco or tobacco products;

(iii) Wood or wood products;

(iv) Articles;

(v) Food, drugs, cosmetics, or alcoholic beverages in a retail establishment which are packaged for sale to consumers;

(vi) Foods, drugs, or cosmetics intended for personal consumption by employees while in the workplace;

(vii) Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 *et seq.*) and Federal Hazardous Substances Act (15 U.S.C. 1261 *et seq.*) respectively, where the employer can demonstrate it is used in the workplace in the same manner as normal consumer use, and which use results in a duration and frequency of exposure which is not greater than exposures experienced by consumers; and.

(viii) Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 *et seq.*), when it is in solid, final form for direct administration to the patient (i.e. tablets or pills).

[¶7686.1]

(c) *Definitions.*

"Article" means a manufactured item: (i) Which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which does not release, or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Chemical" means any element, chemical compound or mixture of elements and/or compounds.

"Chemical manufacturer" means an employer with a workplace where chemical(s) are produced for use or distribution.

"Chemical name" means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

"Combustible liquid" means any liquid having a flashpoint at or above 100 °F (37.8 °C), but below 200 °F (93.3 °C), except any mixture having components with flashpoints of 200 °F (93.3 °C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

"Common name" means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

"Compressed gas" means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 °F (21.1 °C); or

(ii) a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 °F (54.4 °C) regardless of the pressure at 70 °F (21.1 °C); or

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 °F (37.8 °C) as determined by ASTM D-323-72.

"Container" means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

"Designated representative" means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department o Health and Human Services, or designee.

"Distributor" means a business, oth than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

"Employee" means a worker who m be exposed to hazardous chemicals under normal operating conditions or foreseeable emergencies. Workers suc as office workers or bank tellers who encounter hazardous chemicals only i non-routine, isolated instances are not covered.

"Employer" means a person engage in a business where chemicals are eith used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

"Explosive" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

"Exposure" or "exposed" means an employee is subjected to a hazardou chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes potential (e.g. accidental or possible) exposure.

[¶7686.2]

"Flammable" means a chemical that falls into one of the following categories

(i) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(ii) "Gas, flammable" means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percen volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit.

(iii) "Liquid, flammable" means any liquid having a flashpoint below 100 °F (37.8 °C), except any mixture having components with flashpoints of 100 °F (37.8 °C) or higher, the total of which make up 99 percent or more of the total volume of the mixture;

(iv) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in § 190.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

"Flashpoint" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24–1979 (ASTM D 56–79)) for liquids with a viscosity of less than 45 Saybolt University Seconds (SUS) at 100 °F (37.8 °C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7–1979 (ASTM D 93–79)) for liquids with a viscosity equal to or greater than 45 SUS at 100 °F (37.8 °C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTMD 3278–78))

Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

"Foreseeable emergency" means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result in an uncontrolled release of a hazardous chemical into the workplace.

"Hazardous chemical" means any chemical which is a physical hazard or a health hazard.

[¶7686.3]

"Hazard warning" means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the hazard(s) of the chemical(s) in the container(s).

"Health hazard" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendix A provides further definitions and explanations of the scope of health hazards covered by this section, and Appendix B describes the criteria to be used to determine whether or not a chemical is to be considered hazardous for purposes of this standard.

"Identity" means any chemical or common name which is indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS.

"Immediate use" means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

"Importer" means the first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or employers within the United States.

"Label" means any written, printed, or graphic material, displayed on or affixed to containers of hazardous chemicals.

"Material safety data sheet (MSDS)" means written or printed material concerning a hazardous chemical which is prepared in accordance with paragraph (g) of this section.

"Mixture" means any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

"Organic peroxide" means an organic compound that contains the bivalent -O-O-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

"Oxidizer" means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

"Physical hazard" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

"Produce" means to manufacture, process, formulate, or repackage.

"Pyrophoric" means a chemical that will ignite spontaneously in air at a temperature of 130 °F (54.4 °C) or below.

"Responsible party" means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

"Specific chemical identity" means the chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

[¶7686.4]

"Trade secret" means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gi employer an opportunity to obtain an advantage over competitors who do n know or use it. Appendix D sets out t criteria to be used in evaluating trade secrets.

"Unstable (reactive)" means a chemical which in the pure state, or a produced or transported, will vigorou polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"Use" means to package, handle, react, or transfer.

"Water-reactive" means a chemica that reacts with water to release a ga that is either flammable or presents a health hazard.

"Work area" means a room or defir space in a workplace where hazardou chemicals are produced or used, and where employees are present.

"Workplace" means an establi job site, or project, at one geograp location containing one or more work areas.

[¶7686.5]

(d) *Hazard determination.* (1) Chemical manufacturers and importer shall evaluate chemicals produced in their workplaces or imported by them determine if they are hazardous. Employers are not required to evaluate chemicals unless they choose not to re on the evaluation performed by the chemical manufacturer or importer for the chemical to satisfy this requiremen

(2) Chemical manufacturers, importe or employers evaluating chemicals sha identify and consider the available scientific evidence concerning such hazards. For health hazards, evidence which is statistically significant and which is based on at least one positive study conducted in accordance wi established scientific principles is considered to be sufficient to establish hazardous effect if the results of the study meet the definitions of health hazards in this section. Appendix A shall be consulted for the scope of health hazards covered, and Appendix

shall be consulted for the criteria to be followed with respect to the completeness of the evaluation, and the data to be reported.

(3) The chemical manufacturer, importer or employer evaluating chemicals shall treat the following sources as establishing that the chemicals listed in them are hazardous:

(i) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA); or,

(ii) *Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment*, American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition).

The chemical manufacturer, importer, or employer is still responsible for evaluating the hazards associated with the chemicals in these source lists in accordance with the requirements of this standard.

(4) Chemical manufacturers, importers and employers evaluating chemicals shall treat the following sources as establishing that a chemical is a carcinogen or potential carcinogen for hazard communication purposes:

(i) National Toxicology Program (NTP), *Annual Report on Carcinogens* (latest edition);

(ii) International Agency for Research on Cancer (IARC) *Monographs* (latest editions); or

(iii) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

Note.—The *Registry of Toxic Effects of Chemical Substances* published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

(5) The chemical manufacturer, importer or employer shall determine the hazards of mixtures of chemicals as follows:

(i) If a mixture has been tested as a whole to determine its hazards, the results of such testing shall be used to determine whether the mixture is hazardous;

(ii) If a mixture has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as do the components which comprise one percent (by weight or volume) or greater of the mixture, except that the mixture shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1 percent or greater which is considered to be a carcinogen under paragraph (d)(4) of this section;

(iii) If a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the chemical manufacturer, importer, or employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture; and,

(iv) If the chemical manufacturer, importer, or employer has evidence to indicate that a component present in the mixture in concentrations of less than one percent (or in the case of carcinogens, less than 0.1 percent) could be released in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health hazard to employees in those concentrations, the mixture shall be assumed to present the same hazard.

(6) Chemical manufacturers, importers, or employers evaluating chemicals shall describe in writing the procedures they use to determine the hazards of the chemical they evaluate. The written procedures are to be made available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director. The written description may be incorporated into the written hazard communication program required under paragraph (e) of this section.

[¶7686.6]

(e) *Written hazard communication program.* (1) Employers shall develop, implement, and maintain at the workplace, a written hazard communication program for their workplaces which at least describes how the criteria specified in paragraphs (f), (g), and (h) of this section for labels and other forms of warning, material safety data sheets, and employee information and training will be met, and which also includes the following:

(i) A list of the hazardous chemicals known to be present using an identity that is referenced on the appropriate material safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and,

(ii) The methods the employer will use to inform employees of the hazards of non-routine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

(2) *Multi-employer workplaces.* Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on-site) shall additionally ensure that the hazard communication programs developed and implemented under this paragraph (e) include the following:

(i) The methods the employer will use to provide the other employer(s) with a copy of the material safety data sheet, or to make it available at a central location in the workplace, for each hazardous chemical the other employer(s)' employees may be exposed to while working;

(ii) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and,

(iii) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this paragraph (e).

(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the Assistant Secretary and the Director, in accordance with the requirements of CFR 1910.20(e).

[¶7686.7]

(f) *Labels and other forms of warning.* (1) The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged or marked with the following information:

(i) Identity of the hazardous chemical(s);

(ii) Appropriate hazard warnings; and

(iii) Name and address of the chemical manufacturer, importer, or other responsible party.

(2) For solid metal (such as a steel beam or a metal casting) that is not exempted as an article due to its downstream use, the required label may be transmitted to the customer at the time of the intial shipment, and need be included with subsequent shipme[illegible] to the same employer unless the information on the label changes. The label may be transmitted with the initial shipment itself, or with the material safety data sheet that is to be provided prior to or at the time of the first shipment. This exception to requiring labels on every container of hazardous chemicals is only for the solid metal itself and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the metal and to which employees handling the metal may be exposed (for example, cutting fluids or lubricants).

(3) Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this section in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S[illegible] 1801 *et seq.*) and regulations issued under that Act by the Department of Transportation.

(4) If the hazardous chemical is regulated by OSHA in a substance-specific health standard, the chemical

manufacturer, importer, distributor or employer shall ensure that the labels or other forms of warning used are in accordance with the requirements of that standard.

(5) Except as provided in paragraphs (f)(6) and (f)(7) the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with the following information:

(i) Identity of the hazardous chemical(s) contained therein; and

(ii) Appropriate hazard warnings.

(6) The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys the information required by paragraph (f)(5) of this section to be on a label. The written materials shall be readily accessible to the employees in their work area throughout each work shift.

(7) The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer.

(8) The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

(9) The employer shall ensure that labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

(10) The chemical manufacturer, importer, distributor or employer need not affix new labels to comply with this section if existing labels already convey the required information.

[¶7686.8]

(g) *Material safety data sheets.* (1) Chemical manufacturers and importers shall obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Employers shall have a material safety data sheet for each hazardous chemical which they use.

(2) Each material safety data sheet shall be in English and shall contain at least the following information:

(i) The identity used on the label, and, except as provided for in paragraph (i) of this section on trade secrets:

(A) If the hazardous chemical is a single substance, its chemical and common name(s);

(B) If the hazardous chemical is a mixture which has been tested as a whole to determine its hazards, the chemical and common name(s) of the ingredients which contribute to these known hazards, and the common name(s) of the mixture itself; or,

(C) If the hazardous chemical is a mixture which has not been tested as a whole:

(*1*) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise 1% or greater of the composition, except that chemicals identified as carcinogens under paragraph (d)(4) of this section shall be listed if the concentrations are 0.1% or greater; and,

(*2*) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise less than 1% (0.1% for carcinogens) of the mixture, if there is evidence that the ingredient(s) could be released from the mixture in concentrations which would exceed an established OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health hazard to employees; and,

(*3*) The chemical and common name(s) of all ingredients which have been determined to present a physical hazard when present in the mixture;

(ii) Physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point);

(iii) The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity;

(iv) The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical;

(v) The primary route(s) of entry;

(vi) The OSHA permissible exposure limit, ACGIH Threshold Limit Value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available;

(vii) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) *Annual Report on Carcinogens* (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) *Monographs* (latest editions), or by OSHA;

(viii) Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks;

(ix) Any generally applicable control measures which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, such as appropriate engineering controls, work practices, or personal protective equipment;

(x) Emergency and first aid procedures;

(xi) The date of preparation of the material safety data sheet or the last change to it; and,

(xii) The name, address and telephone number of the chemical manufacturer, importer, employer or other responsible party preparing or distributing the material safety data sheet, who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

(3) If not relevant information is found for any given category on the material safety data sheet, the chemical manufacturer, importer or employer preparing the material safety data sheet shall mark it to indicate that no applicable information was found.

(4) Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one material safety data sheet to apply to all of these similar mixtures.

(5) The chemical manufacturer, importer or employer preparing the material safety data sheet shall ensure that the information recorded accurately reflects the scientific evidence used in making the hazard determination. If the chemical manufacturer, importer or employer preparing the material safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the material safety data sheet within three months. If the chemical is not currently being produced or imported the chemical manufacturer or importer sh[illegible] add the information to the material safety data sheet before the chemical is introduced into the workplace again.

[¶7686.9]

(6) Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate material safety data sheet with their intitial shipment, and with the first shipment after a material safety data sheet is updated. The chemical manufacturer or importer shall either provide material safety data sheets with the shipped containers or send them to the employer prior to or at the time of the shipment. If the material safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the employer shall obtain one from the chemical manufacturer, importer, or distributor as soon as possible.

(7) Distributors shall ensure that material safety data sheets, and updated information, are provided to other distributors and employers. Retail distributors which sell hazardous

chemicals to commercial customers shall provide a material safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a material safety data sheet is available. Chemical manufacturers, importers, and distributors need not provide material safety data sheets to retail distributors which have informed them that the retail distributor does not sell the product to commercial customers or open the sealed container to use it in their own workplaces.

(8) The employer shall maintain copies of the required material safety data sheets for each hazardous chemical in the workplace, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s).

(9) Where employees must travel between workplaces during a workshift, *i.e.*, their work is carried out at more than one geographical location, the material safety data sheets may be kept at a central location at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

(10) Material safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in in their work areas(s).

(11) Material safety data sheets shall also be made readily available, upon request, to designated representatives and to the Assistant Secretary, in accordance with the requirements of 29 CFR 1910.20 (e). The Director shall also be given access to material safety data sheets in the same manner.

[¶7686.10]

(h) *Employee information and training.* Employers shall provide employees with information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

(1) *Information.* Employees shall be informed of:

(i) The requirements of this section;

(ii) Any operations in their work area where hazardous chemicals are present; and,

(iii) The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by this section.

(2) *Training.* Employee training shall include at least:

(i) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(ii) The physical and health hazards of the chemicals in the work area;

(iii) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and,

(iv) The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

[¶7686.11]

(i) *Trade secrets.* (1) The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name and other specific identification of a hazardous chemical, from the material safety data sheet, provided that:

(i) The claim that the information withheld is a trade secret can be supported;

(ii) Information contained in the material safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

(iii) The material safety data sheet indicates that the specific chemical identity is being withheld as a trade secret; and,

(iv) The specific chemical identity is made available to health professionals, employees, and designated representatives in accordance with the applicable provisions of this paragraph.

(2) Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need of a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of paragraphs (i)(3) and (4) of this section, as soon as circumstances permit.

(3) In non-emergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity, otherwise permitted to be withheld under paragraph (i)(1) of this section, to a health professional (i.e. physician, industrial hygienist, toxicologist, epidemiologist, or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

(i) The request is in writing;

(ii) The request describes with reasonable detail one or more of the following occupational health needs for the information:

(A) To assess the hazards of the chemicals to which employees will be exposed;

(B) To conduct or assess sampling of the workplace atmosphere to determin employee exposure levels;

(C) To conduct pre-assignment o periodic medical surveillance of exposed employees;

(D) To provide medical treatment to exposed employees;

(E) To select or assess appropriate personal protective equipment for exposed employees;

(F) To design or assess engineering controls or other protective measures f exposed employees; and,

(G) To conduct studies to determine the health effects of exposure.

[¶7686.12]

(iii) The request explains in detail why the disclosure of the specific chemical identity is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representative, would not satisfy the purposes described in paragraph (i)(3)(i of this section:

(A) The properties and effects of the chemical;

(B) Measures for controlling workers exposure to the chemical;

(C) Methods of monitoring and analyzing worker exposure to the chemical; and,

(D) Methods of diagnosing and treating harmful exposures to the chemical;

(iv) The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and,

(v) The health professional, and the employer or contractor of the services of the health professional (i.e. downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional, employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to OSHA, as provided in paragraph (i)(6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

(4) The confidentiality agreement authorized by paragraph (i)(3)(iv) of this section:

(i) May restrict the use of the information to the health purposes indicated in the written statement of need;

(ii) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable pre-estimate of likely damages; and,

(iii) May not include requirements for the posting of a penalty bond.

(5) Nothing in this standard is meant to preclude the parties from pursuing non-contractual remedies to the extent permitted by law.

(6) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to OSHA, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

(7) If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity, the denial must:

(i) Be provided to the health professional, employee, or designated representative, within thirty days of the request;

(ii) Be in writing;

(iii) Include evidence to support the claim that the specific chemical identity is a trade secret;

(iv) State the specific reasons why the request is being denied; and,

(v) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the specific chemical identity.

(8) The health professional, employee, or designated representative whose request for information is denied under paragraph (i)(3) of this section may refer the request and the written denial of the request to OSHA for consideration.

(9) When a health professional, employee, or designated representative refers the denial to OSHA under paragraph (i)(8) of this section, OSHA shall consider the evidence to determine if:

(i) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity is a trade secret;

(ii) The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and,

(iii) The health professional, employee, or designated representative has demonstrated adequate means to protect the confidentiality.

(10)(i) If OSHA determines that the specific chemical identity requested under paragraph (i)(3) of this section is not a *bona fide* trade secret, or that it is a trade secret, but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by OSHA.

(ii) If a chemical manufacturer, importer, or employer demonstrates to OSHA that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret specific chemical identity, the Assistant Secretary may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

(11) If a citation for a failure to release specific chemical identity information is contested by the chemical manufacturer, importer, or employer, the matter will be adjudicated before the Occupational Safety and Health Review Commission in accordance with the Act's enforcement scheme and the applicable Commission rules of procedure. In accordance with the Commission rules,

when a chemical manufacturer, importer, or employer continues to withhold the information during the contest, the Administrative Law Judge may review the citation and supporting documentation *in camera* or issue appropriate orders to protect the confidentiality or such matters.

(12) Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the Assistant Secretary any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the Assistant Secretary so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

(13) Nothing in this paragraph shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret.

(j) *Effective dates.* (1) Chemical manufacturers, importers, and distributors shall ensur hat material safety data sheets are p vided with the next shipment of hazardous chemicals to employers after September 23, 1987.

(2) Employers in the non-manufacturing sector shall be in compliance with all provisions of this section by May 23, 1988. (Note: Employers in the manufacturing sector (SIC Codes 20 through 39) are already required to be in compliance with this section.)

(Approved by the Office of Management and Budget under Control No. 1218–0072)

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Appendix A to § 1910.1200—Health Hazard Definitions (*Mandatory*)

Although safety hazards related to t' physical characteristics of a chemical can be objectively defined in terms of testing requirements (e.g. flammability), health hazard definitions are less precise and more subjective. Health hazards may cause measurable changes in the body—such as decreased pulmonary function. These changes are generally indicated by the occurrence of signs and symptoms in the exposed employees—such as shortness of breath, a non-measurable, subjective feeling Employees exposed to such hazards must be apprised of both the change in body function and the signs and symptoms that may occur to signal that change.

The determination of occupational health hazards is complicated by the fact that many of the effects or signs and symptoms occur commonly in non-occupationally exposed populations, so that effects of exposure are difficult to separate from normally occurring illnesses. Occasionally, a substance causes an effect that is rarely seen in the population at large, such as angiosarcomas caused by vinyl chloride exposure, thus making it r to ascertain that the occupational expos was the primary causative factor. More often however, the effects are common, such as lung cancer. The situation is further complicated by the fact that most chemicals have not been adequately tested to determine their health hazard potential, and data do not exist to substantiate these effects.

There have been many attempts to categorize effects and to define them in various ways. Generally, the terms "acute" and "chronic" are used to delineate between effects on the basis of severity or duration. "Acute" effects usually occur rapidly as a result of short-term exposures, and are of short duration. "Chronic" effects generally occur as a result of long-term exposure, and are of long duration.

The acute effects referred to most frequently are those defined by the American National Standards Institute (ANSI) standard for Precautionary Labeling of Hazardous Industrial Chemicals (Z129.1–1982)—irritation, corrosivity, sensitization and lethal dose. Although these are important health effects, they do not adequately cover th considerable range of acute effects which may occur as a result of occupational exposure, such as, for example, narcosis.

Similarly, the term chronic effect is often used to cover only carcinogenicity, teratogenicity, and mutagenicity. These effects are obviously a concern in the workplace, but again, do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasias (such as enemia), chronic bronchitis and liver atrophy.

The goal of defining precisely, in measurable terms, every possible health effect that may occur in the workplace as a result of chemical exposures cannot realistically be accomplished. This does not negate the need for employees to be informed of such effects and protected from them. Appendix B, which is also mandatory, outlines the principles and procedures of hazardous assessment.

For purposes of this section, any chemicals which meet any of the following definitions, as determined by the criteria set forth in Appendix B are health hazards:

1. *Carcinogen:* A chemical is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or

(b) It is listed as a carcinogen or potential carcinogen in the *Annual Report on Carcinogens* published by the National Toxicology Program (NTP) (latest edition); or,

(c) It is regulated by OSHA as a carcinogen.

2. *Corrosive:* A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

3. *Highly toxic:* A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal does (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

4. *Irritant:* A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

5. *Sensitizer:* A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

6. *Toxic.* A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD_{50}) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

7. *Target organ effects.* The following is a target organ categorization of effects which may occur, including examples of signs and symptoms and chemicals which have been found to cause such effects. These examples

are presented to illustrate the range and diversity of effects and hazards found in the workplace, and the broad scope employers must consider in this area, but are not intended to be all-inclusive.

a. Hepatotoxins: Chemicals which produce liver damage
  Signs & Symptoms: Jaundice; liver enlargement
  Chemicals: Carbon tetrachloride; nitrosamines

b. Nephrotoxins: Chemicals which produce kidney damage
  Signs & Symptoms: Edema; proteinuria
  Chemicals: Halogenated hydrocarbons; uranium

c. Neurotoxins: Chemicals which produce their primary toxic effects on the nervous system
  Signs & Symptoms: Narcosis; behavioral changes; decrease in motor functions
  Chemicals: Mercury; carbon disulfide

d. Agents which act on the blood or hematopcietic system: Decrease hemoglobin function; deprive the body tissues of oxygen
  Signs & Symptoms: Cyanosis; loss of consciousness
  Chemicals: Carbon monoxide; cyanides

e. Agents which damage the lung: Chemicals which irritate or damage the pulmonary tissue
  Signs & Symptoms: Cough; tightness in chest; shortness of breath
  Chemicals: Silica; asbestos

f. Reproductive toxins: Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis)
  Signs & Symptoms: Birth defects; sterility
  Chemicals: Lead; DBCP

g. Cutaneous hazards: Chemicals which affect the dermal layer of the body
  Signs & Symptoms: Defatting of the skin; rashes; irritation
  Chemicals: Ketones; chlorinated compounds

h. Eye hazards: Chemicals which affect the eye or visual capacity
  Signs & Symptoms: Conjunctivitis; corneal damage
  Chemicals: Organic solvents; acids

[¶7686.14]

Appendix B to § 1910.1200—Hazard Determination (Mandatory)

The quality of a hazard communication program is largely dependent upon the adequacy and accuracy of the hazard determination. The hazard determination requirement of this standard is performance-oriented. Chemical manufacturers, importers and employers evaluating chemicals are not required to follow any specific methods for determining hazards, but they must be able to demonstrate that they have adequately ascertained the hazards of the chemicals produced or imported in accordance with the criteria set forth in this Appendix.

Hazard evaluation is a process which relies heavily on the professional judgment of the evaluator, particularly in the area of chronic hazards. The performance-orientation of the hazard determination does not diminish the duty of the chemical manufacturer, importer or employer to conduct a thorough evaluation, examining all relevant data and producing a scientifically defensible evaluation. For purposes of this standard, the following criteria shall be used in making hazard determinations that meet the requirements of this standard.

1. *Carcinogenicity*: As described in paragraph (d)(4) and Appendix A of this section, a determination by the National Toxicology Program, the International Agency for Research on Cancer, or OSHA that a chemical is a carcinogen or potential carcinogen will be considered conclusive evidence for purposes of this section.

2. *Human data*: Where available, epidemiological studies and case reports of adverse health effects shall be considered in the evaluation.

3. *Animal data*: Human evidence of health effects in exposed populations is generally not available for the majority of chemicals produced or used in the workplace. Therefore, the available results of toxicological testing in animal populations shall be used to predict the health effects that may be experienced by exposed workers. In particular, the definitions of certain acute hazards refer to specific animal testing results (see Appendix A).

4. *Adequacy and reporting of data.* The results of any studies which are designed and conducted according to established scientific principles, and which report statistically significant conclusions regarding the health effects of a chemical, shall be a sufficient basis for a hazard determination and reported on any material safety data sheet. The chemical manufacturer, importer, or employer may also report the results of other scientifically valid studies which tend to refute the findings of hazard.

[¶7686.15]

Appendix C to § 1910.1200—Information Sources (Advisory)

The following is a list of available data sources which the chemical manufacturer, importer, distributor, or employer may wish to consult to evaluate the hazards of chemicals they produce or import:

—Any information in their own company files, such as toxicity testing results or illness experience of company employees.

—Any information obtained from the supplier of the chemical, such as material safety data sheets or product safety bulletins

—Any pertinent information obtained from the following source list (latest editions should be used):

Condensed Chemical Dictionary
Van Nostrand Reinhold Co., 135 West 50th Street, New York, NY 10020.

The Merck Index: An Encyclopedia of Chemicals and Drugs
Merck and Company, Inc., 126 E. Lincoln Ave., Rahway, NJ 07065.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man
Geneva: World Health Organization, International Agency for Research on Cancer, 1972–Present. (Multivolume work). Summaries are available in supplement volumes. 49 Sheridan Street, Albany, NY 12210.

Industrial Hygiene and Toxicology, by F.A. Patty
John Wiley & Sons, Inc., New York, NY (Multivolume work).

Clinical Toxicology of Commercial Products
Gleason, Gosselin, and Hodge

Casarett and Doull's Toxicology: The Basic Science of Poisons
Doull, Klaassen, and Amdur, Macmillan Publishing Co., Inc., New York, NY.

Industrial Toxicology, by Alice Hamilton and Harriet L. Hardy
Publishing Sciences Group, Inc., Acton, MA.

Toxicology of the Eye, by W. Morton Grant
Charles C. Thomas, 301-327 East Lawrence Avenue, Springfield, IL.

Recognition of Health Hazards in Industry
William A. Burgess, John Wiley and Sons, 605 Third Avenue, New York, NY 10158.

Chemical Hazards of the Workplace
Nick H. Proctor and James P. Hughes, J.P. Lipincott Company, 6 Winchester Terrace, New York, NY 10022.

Handbook of Chemistry and Physics
Chemical Rubber Company, 18901 Cranwood Parkway, Cleveland, OH 44128.

Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices with Intended Changes
American Conference of Governmental Industrial Hygienists (ACGIH), 6500 Glenway Avenue, Bldg. D-5, Cincinnati, OH 45211.

Information on the physical hazards of chemicals may be found in publications of the National Fire Protection Association, Boston, MA.

Note.—The following documents may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Occupational Health Guidelines
NIOSH/OSHA (NIOSH Pub. No. 81-123)

NIOSH Pocket Guide to Chemical Hazards
NIOSH Pub. No. 85-114

Registry of Toxic Effects of Chemical Substances
NIOSH Pub. No. 80-102

Miscellaneous Documents published by the National Institute for Occupational Safety and Health:
Criteria documents.
Special Hazard Reviews.
Occupational Hazard Assessments.
Current Intelligence Bulletins.

OSHA's General Industry Standards (29 CFR Part 1910)

NTP Annual Report on Carcinogens and *Summary of the Annual Report on Carcinogens.*
National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161; (703) 487-4650.

BIBLIOGRAPHIC DATA BASES

Service provider	File name
Bibliographic Retrieval Services (BRS), 1200 Route 7, Latham, NY 12110.	Biosis Previews
	CA Search
	Medlars
	NTIS
	Hazardline
	American Chemical Society Journal
	Excerpta Medica
	IRCS Medical Science Journal
	Pre-Med
	Intl Pharmaceutical Abstracts
	Paper Chem
Lockheed—DIALOG Information Service, Inc., 3460 Hillview Avenue, Palo Alto, CA 94304.	Biosis Prev. Files
	CA Search Files
	CAB Abstracts
	Chemical Exposure
	Chemname
	Chemsis Files
	Chemzero
	Embase Files
	Environmental Bibliographies
	Enviroline
	Federal Research in Progress
	IRL Life Science Collection
	NTIS
	Occupational Safety and Health (NIOSH)
	Paper Chem
SDC—Orbit, SDC Information Service, 2500 Colorado Avenue, Santa Monica, CA 90406.	CAS Files
	Chemdex, 2, 3
	NTIS
National Library of Medicine, Department of Health and Human Services, Public Health Service, National Institutes of Health, Bethesda, MD 20209.	Hazardous Substances Data Bank (NSDB)
	Medline files
	Toxline Files
	Cancerlit
	RTECS
	Chemline
Pergamon International Information Corp., 1340 Old Chain Bridge Rd., McLean, VA 22101.	Laboratory Hazard Bulletin
Questel, Inc., 1625 Eye Street, NW., Suite 818, Washington, DC 20006.	CIS/ILO
	Cancernet
Chemical Information System ICI (ICIS), Bureau of National Affairs, 1133 15th Street, NW., Suite 300, Washington, DC 20005.	Structure and Nomenclature Search System (SANSS)
	Acute Toxicity (RTECS)
	Clinical Toxicology of Commercial Products
	Oil and Hazardous Materials Technical Assistance Data System
	CCRIS
	CESARS
Occupational Health Services, 400 Plaza Drive, Secaucus, NJ 07094.	MSDS
	Hazardline

[¶7686.16]

Appendix D to § 1910.1200—Definition of "Trade Secret" (Mandatory)

The following is a reprint of the *Restatement of Torts* section 757, comment *b* (1939):

b. Definition of trade secret. A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers. It differs from other secret information in a business (see § 759 of the *Restatement of Torts* which is not included in this Appendix) in that it is not simply information as to single or ephemeral events in the conduct of the business, as, for example, the amount or other terms of a secret bid for a contract or the salary of certain employees, or the security investments made or contemplated, or the date fixed for the announcement of a new policy or for bringing out a new model or the like. A trade secret is a process or device for continuous use in the operations of the business. Generally it relates to the production of goods, as, for example, a machine or formula for the production of an article. It may, however, relate to the sale of goods or to other operations in the business, such as a code for determining discounts, rebates or other concessions in a price list or catalogue, or a list of specialized customers, or a method of bookkeeping or other office management.

Secrecy. The subject matter of a trade secret must be secret. Matters of public knowledge or of general knowledge in an industry cannot be appropriated by one as his secret. Matters which are completely disclosed by the goods which one markets cannot be his secret. Substantially, a trade secret is known only in the particular business in which it is used. It is not requisite that only the proprietor of the business know it. He may, without losing his protection, communicate it to employees involved in its use. He may likewise communicate it to others pledged to secrecy. Others may also know of it independently, as, for example, when they have discovered the process or formula by independent invention and are keeping it secret. Nevertheless, a substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information. An exact definition of a trade secret is not possible. Some factors to be considered in determining whether given information is one's trade secret are: (1) The extent to which the information is known outside of his business; (2) the extent to which it is known by employees and others involved in his business; (3) the extent of measures taken by him to guard the secrecy of the information; (4) the value of the information to him and his competitors; (5) the amount of effort or money expended by him in developing the information; (6) the ease or difficulty with which the information could be properly acquired or duplicated by others.

Novelty and prior art. A trade secret may be a device or process which is patentable; but it need not be that. It may be a device or process which is clearly anticipated in the prior art or one which is merely a mechanical improvement that a good mechanic can make. Novelty and invention are not requisite for a trade secret as they are for patentability. These requirements are essential to patentability because a patent protects against unlicensed use of the patented device or process even by one who discovers it properly through independent research. The patent monopoly is a reward to the inventor. But such is not the case with a trade secret. Its protection is not based on a policy of rewarding or otherwise encouraging the development of secret processes or devices. The protection is merely against breach of faith and reprehensible means of learning another's secret. For this limited protection it is not appropriate to require also the kind of novelty and invention which is a requisite of patentability. The nature of the secret is, however, an important factor in determining the kind of relief that is appropriate against one who is subject to liability under the rule stated in this section. Thus, if the secret consists of a device or process which is a novel invention, one who acquires the secret wrongfully is ordinarily enjoined from further use of it and is required to account for the profits derived from his past use. If, on the other hand, the secret consists of mechanical improvements that a good mechanic can make without resort to the secret, the wrongdoer's liability may be limited to damages, and an injunction against future use of the improvements made with the aid of the secret may be inappropriate.

[Revised § 1910.1200 added at 52 F.R. 31852, August 24, 1987; effective September 23, 1987.]

[¶7687]

§ 1910.1450 Occupational exposure to hazardous chemicals in laboratories.

(a) *Scope and application.* (1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(i) For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

(iii) Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements, paragraphs (d) and (g)(1)(ii) of this section shall apply.

(3) This section shall not apply to:

(i) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

(ii) Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

(A) Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

(B) Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

[¶7687.1]

(b) *Definitions*—

"*Action level*" means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

"*Assistant Secretary*" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Appendix C

Tennessee
Variations from Federal
Hazard Communications Standards

TENNESSEE

(OSHA STATE-PLAN STATE)

WORKER RIGHT-TO-KNOW

LEGISLATION: Tennessee Hazardous Chemical Right-to-Know Law; Tennessee Code Annotated Sections 50-3-2001 through 50-3-2019

ENACTED: May 28, 1985

REGULATION: Chapter 0800-1-9, Hazardous Chemical Right-to-Know

REGULATION: Hazard Communication Standard, Chapter 0800-1-1-.1200

ADMINISTRATING AGENCY: Tennessee Department of Labor, Division of Occupational Safety and Health

CONTACT: Chief of Standards and Procedures or the Assistant Director of the Division of Occupational Safety and Health

PHONE: 615-741-7151 or 741-3161

COMMUNITY RIGHT-TO-KNOW

The notification of emergency response authority is implemented by the Department of Labor.

ADMINISTRATING AGENCY (SARA Title III): Tennessee Emergency Management Agency

ADDRESS: 3041 Sidco Drive, P.O. Box 41502, Nashville, TN 37204-1502

CONTACT: Office of Emergency Management Council

PHONE: 615-252-3300; or TOLL-FREE **(out of state)** 1-800-258-3300, or
(Tennessee) 1-800-262-3300 or 1-800-322-TEMA

VARIATIONS FROM HC STANDARD

Tennessee is a state-plan state and has a federally approved job safety and health plan. It has a federally approved state Right-to-Know law that is enforced by state authorities in the private and public sectors.

(1) SCOPE AND APPLICATION OF LAW

The Department of Labor has adopted and enforces the HC Standard in all sectors. In addition, the state passed a law and the Department adopted rules to implement that law, which contain certain provisions that go beyond the federal requirements. Tennessee presently enforces hazard communication in all sectors.

Any employer or class of employers who wish to be exempted from compliance with this Act or any part of this Act such as an exemption from the annual refresher training rule, must file a written application with the Commissioner of Labor.

(2) EXEMPTIONS

Agricultural workplaces are exempt from the state law if the Commissioner of the Department of Agriculture certifies that the chemicals are covered by other federal or state laws and regulations.

TENNESSEE

(OSHA STATE-PLAN STATE)

The state law exempts workplaces where hazardous chemicals are received in sealed packages that are later sold or transferred in that package if the seal remains intact while the chemicals are in the workplace, AND **if the chemical does not remain in the workplace more than 14 days**.

(3) TOXIC SUBSTANCES LIST

Tennessee's law covers the same chemicals as does the HC Standard. However, there are some additional state requirements regarding a **workplace chemical list** (WCL). **The state law**, **however, also requires the Chemical Abstracts Service (CAS) number** be provided for each hazardous chemical if the number is included on the MSDS. Employers must file significant changes to their WCLs with the Commissioner of Labor within 30 days following such changes.

The WCL must be maintained for no less than thirty years. If the employer generating such lists ceases to do business within the state, the complete records regarding the WCL must be sent to the Commissioner within 90 days. The WCL must be updated as necessary but not less than annually.

The WCL must contain the following information:

1) the employer's name and mailing address;

2) the workplace location, if different from mailing address;

3) the employer's primary SIC Code;

4) the employer's federal employer identification number;

5) a brief description of the workplace operation;

6) the chemical name or common name used on the MSDS and/or the container label;

7) **the Chemical Abstracts Service number** for each hazardous chemical listed, if such number is known or included on the MSDS; and

8) the work area or workplace in which the hazardous chemical is normally used, stored, or generated.

(4) POSTING REQUIREMENTS

All non-manufacturing employers are required to post a notice informing employees of their rights under the state Right-to-Know law. Posting of employee rights under the Hazard Communication Standard is not required, but is recommended by the state. The Department of Labor has a general workplace poster, and a hazard communication poster, both of which are available upon request.

If employers have non-containerized hazardous chemicals that are generated or produced as a result of a process or operation taking place in a work area, they must post a sign or placard that identifies and indicates appropriate hazard warnings for the hazardous chemicals (e.g. welding fumes, carbon monoxide from industrial truck exhaust).

Employers and distributors that normally store a hazardous substance in excess of 55 gallons or 500 pounds, and have workplaces that occupy an entire building or structure **are required** to place one National Fire Protection Association (NFPA) 704M placard on the outside of any building that contains any of the following (please refer to NFPA material included in labeling section):

1) class A explosive;

2) class B explosive;

3) poison gas (poison A);

4) water-reactive flammable solid (flammable solid w), or radioactive material as listed in Table I of Federal Department of Transportation (DOT) regulations, 49 CFR, Part 172), and further defined in federal DOT regulations 49 CFR, Part 173; or

5) any other hazardous chemical normally stored in amounts greater than 55 gallons or 500 pounds.

The Commissioner will issue rules to establish specifications regarding the size, color, lettering and posting requirements pursuant to the NFPA 704M series. These regulations must provide that the number used must be determined by the hazardous chemical presenting the greatest danger.

The Commissioner may exempt employers from these NFPA posting requirements if the employer can satisfactorily demonstrate that:

1) the employer maintains a trained fire or emergency preparedness team considered capable of handling emergency situations without external assistance; or

2) the employer maintains twenty-four (24) hour security personnel who maintain accurate records as to location of chemicals, and who can readily direct emergency personnel to affected facilities.

(5) LABELS AND OTHER FORMS OF WARNING

Tennessee requires employers to label containers that hazardous substances are transferred into with the same required information as the source container. The original source container should include the identity and appropriate hazard warnings. (This requirement does not apply to immediate-use containers, which are exempt from labeling. While this language does not appear in the HC Standard, it meets the enforcement guidelines for the HC Standard.)

If an employer is transferring a substance that is regulated by either the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) or the Tennessee Application of Pesticides Act of 1978, the employer must reproduce both the chemical name and the common name from the original container onto the container into which the hazardous chemical was transferred.

Employees cannot be required to work with a hazardous chemical from an unlabeled container or in an un-signed or un-placarded work area. However, it is acceptable to have a stationary process container or work area that is labeled, using the batch ticket or process sheet form of hazard warning.

(6) MATERIAL SAFETY DATA SHEETS (MSDSs)

The state law requires MSDSs to include the same information that is required by the HC Standard. There are, however, variations regarding time limitations and maintenance of MSDSs.

If an MSDS is not received with a shipment, employers must submit a written request for missing MSDSs within five days after receipt of the shipment. Records of such requests shall be maintained for a period of three years following the year in which the request was made.

If an employee submits a written request for an MSDS, the employer has three days to provide a copy of the MSDS to the requestor. If the employer does not have the MSDS readily available, he must demonstrate to the requestor (within three days) that an effort has been made to obtain the MSDS from the supplier.

If the MSDS is unavailable after fourteen calendar days from the receipt of the original request, the employee cannot be required to work with the hazardous chemical, unless the employer can demonstrate to the employee or his representative that the MSDS will be available by a specific date, or that the information cannot be obtained through any fault of the employer. If on the date specified by the employer, the MSDS is still unavailable, the employee cannot be required to work with the hazardous chemical for which the MSDS was requested.

A manufacturer may meet the requirement of supplying an MSDS by sending a written statement that the substance in question is not or does not contain a hazardous chemical. Copies of an MSDS must be provided to the Commissioner, upon request.

Any contractor or subcontractor who introduces hazardous substances into another employer's workplace must provide MSDSs for the chemicals **prior to introducing such hazardous chemicals**.

(7) EMPLOYEE RIGHTS, INFORMATION, AND TRAINING

Employers must provide their employees with **annual refresher training** after the initial training is conducted. **The Commissioner has the authority to grant exemptions from annual refresher training.**

Training records must be maintained for the period an employee is employed, plus five years. Training records must be made available to the Commissioner and must contain at least the following information:

1) identification of employee by name, social security number, or other method;

2) the dates of training; and

3) a brief description of the training given.

Non-manufacturers are required to provide new or newly assigned employees with training **before** working in a work area containing hazardous chemicals.

The Commissioner must develop and maintain a general education and training assistance program to **aid those employers** who, because of size or other practical considerations, are unable to develop such programs by themselves. Such a program must be made available upon request. (This already is provided for in the state's Occupational Safety and Health Code, and was re-stated in this Chapter.)

Provisions also must be made by employers to appropriately inform and train those employees who may be functionally illiterate.

The law **specifically states** that the effectiveness ~~of an~~ employer's training "will be measured by adequacy of reasonable **basic and simple verbal recall** by the employee of information required" to be provided by the state law. "During the course of inspections or investigations, according to the state law (rule 0800-1-9-.14), **Compliance Officers must evaluate training through employee interviews**".

(8) NOTIFICATION OF EMERGENCY RESPONSE AUTHORITY

Employers and distributors that normally store a hazardous substance in amounts greater than 55 gallons or 500 pounds must provide information to the fire chief having jurisdiction in the area where the workplace is located. The fire chief must be provided, in writing, the name(s) and telephone number(s) of knowledgeable representative(s) of the employer who can be contacted for further information or in an emergency. Each employer and distributor must provide a copy of the workplace chemical list to the fire chief as well as updates on the list as significant changes occur.

The fire chief or his representative, upon request, must be permitted on-site inspections of the hazardous chemicals that appear on the workplace chemical list for the sole purpose of pre-planning fire department activities. Employers and distributors, upon written request, must provide the fire chief a copy of the MSDS for any chemical on their workplace chemical list.

It is recommended that you contact the fire department for your jurisdiction to determine any more specific requirements for these provisions.

(9) WRITTEN HAZARD COMMUNICATION PROGRAM

Tennessee requires employers to include a copy of the Workplace Chemical List. (See section 3 of this state variation sheet.)

(10) ADDITIONAL DEFINITIONS & SIGNIFICANT VARIATIONS

Workplace Chemical List—the list of hazardous chemicals developed by the employer as part of the requirements of the law. The information required to be included on the workplace chemical list is described earlier in section (3).

APPENDIX T

DIRECTIONS TO EMERGENCY MEDICAL FACILITIES

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

HOSPITAL

SHIPYARD CLINIC
McMILLAN STREET
CHARLESTON NAVAL SHIPYARD
CHARLESTON, SOUTH CAROLINA
EMERGENCY NUMBER: (803) 743-5444

If on the base, the Shipyard Clinic will be the last building on the right when approaching Gate 3.)

DIRECTIONS TO THE NEAREST HOSPITAL CAPABLE OF TREATING CHEMICAL EXPOSURES

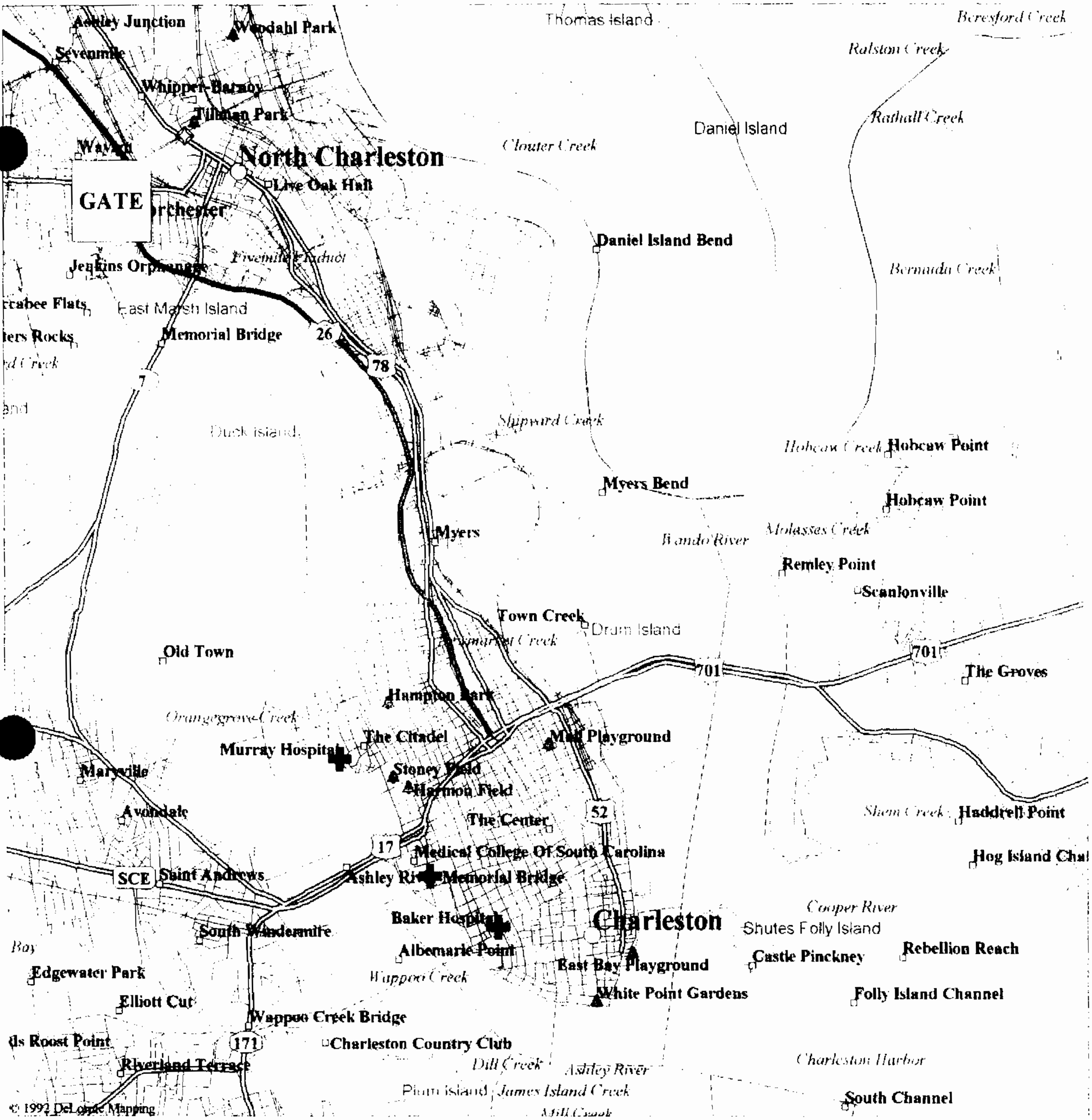
HOSPITAL

NAVAL HOSPITAL - CHARLESTON
McMILLAN STREET
CHARLESTON, SOUTH CAROLINA
EMERGENCY NUMBER: (803) 743-5444

From Gate 3:

1. Proceed on McMillan Street for three (3) blocks.

2. The Naval Hospital will be at the corner of McMillan and Rivers Ave.



LEGEND

State route
Interstate route
Marker
U.S. route
Named highway
Boundary
City
Road
Small town
Walkway, alley
Park
Interstate highway

Scale 1:62,500 (at center)

1 Miles

2 KM

Mag 12.80

APPENDIX U

HEALTH AND SAFETY PLAN FORMS

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project work site and returned to, EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No:2151-029

Contract No:N62467-89-D-0318

Project:CHARLESTON NAVAL SHIPYARD (SWMUs 1-36)

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

____

Signed

____

Print Name

Company

Date

EMPLOYEE EXPOSURE HISTORY FORM

EMPLOYEE: ______________________

JOB NAME: ______________________

DATE(S) FROM/TO: ______________________

HOURS ON SITE: ______________________

CONTAMINANTS (SUSPECTED/REPORTED):

____

____

____

____

____

____